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AFWAL-TR-82-2017

TRANSONIC FAN/COMPRESSOR ROTOR DESIGN STUDY

Volume I

D.E. Parker and M.R. Simonson

General Electric Company
Aircraft Engine Business Group
Advanced Technology Programs Dept.
Cincinnati, Ohio 45215

February 1982

Final Report for Period September 1980 - February 1982

Aero Propulsion Laboratory
Air Force Wright Aeronautical Laboratories
Air Force System Command
Wright-Patterson Air Force Base, Ohio 45433

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This technical report has been reviewed and is approved for publication.

Arthur J. Wennerstrom

ARTHUR J. WENNERSTROM
Chief, Compressor Research Group

Walker H. Mitchell

WALKER H. MITCHELL
Chief, Technology Branch

FOR THE COMMANDER

H I Bush

H. IVAN BUSH
Director, Turbine Engine Division

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REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER	AFWAL-TR-82-2017
2. GOVT ACCESSION NO.	AD-B069 484L
3. RECIPIENT'S CATALOG NUMBER	
4. TITLE (and Subtitle)	Transonic Fan/Compressor Rotor Design Study Volume I
5. TYPE OF REPORT & PERIOD COVERED	Final Technical Report September 1980 - July 1982
6. PERFORMING ORG. REPORT NUMBER	R82AEB328, Volume I
7. AUTHOR(s)	D.E. Parker M.R. Simonson
8. CONTRACT OR GRANT NUMBER(s)	F33615-80-C-2059
9. PERFORMING ORGANIZATION NAME AND ADDRESS	General Electric Company Aircraft Engine Business Group Cincinnati, Ohio 45215
10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS	Project 2307 Task S1 Work Unit 38
11. CONTROLLING OFFICE NAME AND ADDRESS	Aero Propulsion Laboratory (AFWAL/POT) Air Force Wright Aeronautical Laboratories Air Force System Command Wright-Patterson Air Force Base, Ohio 45433
12. REPORT DATE	~~September~~ 1982
13. NUMBER OF PAGES	53
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)	
15. SECURITY CLASS. (of this report)	Unclassified
15a. DECLASSIFICATION/DOWNGRADING SCHEDULE	

16. DISTRIBUTION STATEMENT (of this Report)

Distribution limited to U.S. Government agencies only: Test and Evaluation, ~~September~~ 198~~2~~. Other requests for this document must be referred to Air Force Aero Propulsion Laboratory (AFWAL/POTX), Wright-Patterson AFB, OH 45433.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Fan	Aircraft Engines
Compressor	Blade Thickness
Rotor	Camber Distribution
Aerodesign	Throat Margin
Aerodynamics	

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Volumes I through VI of this report describes the aerodynamic design of a series of five transonic rotors all parametrically related to a baseline design documented in Technical Report AFAPL-TR-79-2078. Each of the five designs deviate from the base line, in so far as practical, by a variation of one parameter only. The parametric variations are specified at the rotor tip. The original hub characteristics were preserved to the maximum extent practical. The varied parameter was adjusted along the span.

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The report contains six volumes. Volume I contains primarily introduction and summary information plus details of a data match analysis of the base design. Volumes II through VI each contain design details for one of the series of five rotors.

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VOLUME I

BASELINE DESIGN

Foreword

This Final Technical Report was prepared by the Advanced Technology Programs Department, Aircraft Engine Business Group, General Electric Company, Evendale , Ohio for the United States Air Force Systems Command, Air Force Wright Aeronautical Laboratories Wright-Patterson Air Force Base, Ohio under Contract F33615-80-C-2059. The work was performed over a period of one year starting in September 1980. Effren Strain (Captain USAF) was the Air Force Project Engineer for this program.

This report describes the results of an effort to aerodynamically define five rotor designs, all parametrically related to a base line design which could be evaluated by future testing in order to define the sensitivity of transonic blade rows to several design variables.

For the General Electric Company Mr. D.E. Parker was the Technical Program Manager for this program. Mr. M.R. Simonson was the principal investigator. Mr. A.J. Bilhardt was the overall Program Manager.

VOLUME I

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VOLUME I

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LIST OF SYMBOLS AND ABBREVIATIONS

1. Used in Circumferential Average Flow Output Tables

STA	calculation station number	
WTF	total airflow	
PSIC	stream function (0 = tip (OD), 1 = hub (ID))	
Z	axial location	inches
R	radius	inches
PHI	streamline slope	degrees
CURV	streamline curvature = neg., = pos.	1/inches
VM	meridional velocity	ft/sec
CU	absolute tangential velocity	ft/sec
ALPHAM	absolute flow angle on stream surface	degrees
MM	meridional Mach number	
SL	calculation streamline number	
BLDBLK	flow blockage factor	(free area - blocked area)/free area
PS	static pressure	psia
PT	total pressure	psia
TT	total temperature	degrees
BETAM	relative flow angle on stream surface	degrees
UREL	relative velocity	ft/sec
MREL	relative Mach number	
VABS	absolute velocity	ft/sec
MABS	absolute Mach number	
GAMMA	specific heat ratio	
PT-RAT	total pressure/inlet total pressure	
TT-RAT	total temperature/inlet total temperature	
RCU	radius x tangential velocity	in-ft/sec
CZ	axial velocity	ft/sec
PCT IMM	percent annulus immersion from tip (OD)	
RAD	average of leading and trailing edge streamline radii	inches
ACC PT RATIO	cumulative total pressure ratio	
ACC TT RATIO	cumulative total temperature ratio	

LIST OF SYMBOLS AND ABBREVIATIONS

1. Used in Circumferential Average Flow Output Tables (Cont'd)

AD.	adiabatic efficiency	
POLY	polytropic efficiency	
Axial VEL R	axial velocity ratio across blade row	

2. Used in Stream Surface Blade Coordinate Tables

PT	point number	
PCT X	fraction of meridional distance from leading edge	
X	meridional coordinate on meanline	inches
Y	tangential coordinate on meanline	inches
B*M	meanline angle on stream surface	degrees
T(M)	thickness of blade perpendicular to meanline	inches
XS	meridional coordinate on suction surface	inches
YS	tangential coordinate on suction surface	inches
XP	meridional coordinate on pressure surface	inches
YP	tangential coordinate on pressure surface	inches

3. Used in Plane Section Coordinate Tables

Z	axial coordinate of stacking axis	inches
R	radius of coordinate system origin	inches
MU	tilt angle in axial direction	degrees
ETA	tilt angle in tangential direction	degrees
RHO	section height	inches
PT	point number	
ALPHA	axial coordinate	inches
BETA*	meanline angle from axial	degrees
UPSILON	coordinate perpendicular to ALPHA and radius	inches
PCT AL	fraction of axial distance from leading edge	
T/C	local thickness/chord ratio	

SECTION I
INTRODUCTION

Exploratory development programs funded by the Department of Defense, and similar programs supported by NASA, have traditionally attempted to advance the component state of the art by increasing component overall performance goals, each time relative to a previous program or a known level of achievement. Although major progress has been achieved in this manner, it is also apparent that in certain detailed areas of design, the same assumptions are made time after time for no better reason than past experience has proven them "safe"; i.e., they have a high probability of providing a satisfactory, if not optimum, design. At present, there exists no good basis from which to depart from many of these assumptions, because neither IR&D programs nor Government-funded programs, as presently structured, have provided a data matrix that is sufficiently systematic to allow one to assess the sensitivity of component behavior to variations in these favorite assumptions. Although analysis in the subsonic area has proven able to distinguish these sensitivities, this is not yet true in the transonic area and is not likely to be for several years to come. To achieve further performance improvements in transonic compressor stages, it would be desirable to conduct a comprehensive experimental program aimed at exploring the sensitivity of compressor performance to variations in several common design parameters.

One parameter, sometimes defined more on the basis of historical reasons than on a knowledge of its aerodynamic effect, is the chordwise location of maximum blade thickness. Research by NACA in the 1950's generally indicated that as relative inlet Mach number rose, it was desirable to move the location of maximum thickness aft on an airfoil. This may remain true. However, the early work was done with airfoils having significant positive camber. Today, many airfoils at rotor tips have little overall relative turning, sometimes negative turning, and frequently have camber lines of S-shape: negative camber followed by some positive camber. In some instances with S-shaped camber lines, a shift in maximum airfoil thickness forward of the more customary location would reduce the peak curvature of the airfoil, assuming all other design criteria were held constant. There are other incentives to move thickness forward related to meeting bird-strike structural criteria. Rather than penalizing aerodynamic performance, it might even be improved in some instances.

Another design variable commonly considered in transonic and supersonic blade rows is the throat margin, and the interrelation between the airfoil mean line shape and the cascade throat area. While there is some variation in the way throat margin is defined, it is common practice to specify some minimum acceptable throat margin over that "theoretically" required accounting for leading edge shock loss, stream tube contraction, etc.

Increasing the average suction surface angle in the supersonic region ahead of the leading edge passage shock reduces the average Mach number just ahead of the shock and presumably reduces the shock loss. However, this results in a reduced cascade throat area. If the throat is too small, the cascade will not pass the design flow and may not achieve the attached shock pattern which is desired for minimum loss.

Also, if the blade suction surface angle is made steep ahead of the cascade mouth, or covered portion, it may be necessary to have a rapid change in blade mean line angle at the cascade mouth to prevent the throat from becoming too small within the covered channel. A rapid change of the suction surface angle increases the surface Mach number ahead of the shock and tends to worsen the shock-boundary layer interaction. This consideration may influence the optimum throat margin for best efficiency.

If the throat area is sufficient to pass the design flow, then (for transonic cascades) the maximum flow is limited by the average suction surface angle in the flow induction region ahead of the first captured Mach wave. The average suction surface angle in this region cannot be increased and still pass the desired flow so that any increase in surface angle must take place aft of this region.

Another parameter which can influence the performance of transonic cascades is the "effective camber" of the blade. The term "effective camber" is loosely used to indicate the circulation capacity of the cascade, since the normal camber definition is not sufficient for cascades with nonstandard mean lines which may depart significantly from a circle arc.

The best efficiency at the design speed for transonic rotors normally occurs near the "knee" of the pressure ratio - flow characteristic where the flow begins to decrease. For the baseline rotor the peak efficiency at design speed was about 2 points higher than that at the test data point selected as the base for the designs carried out under this contract. This peak efficiency occurred at a pressure ratio about 8 percent higher than the selected data point. The baseline point was selected for this work because it provides reasonable stall margin. If it is thought of as an "operating line" point, then there is reason to think that an improvement in efficiency might be achieved at this "operating line" point by adjusting the effective camber so that the "knee" of the characteristic more nearly coincides with the operating line point. The reduced effective camber does not necessarily reduce the stall line, however, it may have an adverse effect on the efficiency at reduced RPM operation. However, currently there is inadequate definitive data to allow an assessment of the trade.

The objective of the work presented in this report was to perform the aerodynamic design of a series of five transonic compressor rotors, all parametrically related to a base line design documented in Reference 1. This base line design was a high-through-flow, high-aerodynamic-loading, low hub tip ratio compressor first stage and was the result of a redesign effort by the Air Force Aero Propulsion Laboratory to improve the aeromechanical performance of a similar earlier design. Each of the five designs deviate from the baseline, in so far as practical, by a variation of one parameter only. The parameter variations are specified at the rotor tip. The original hub characteristics were preserved to the maximum extent practical. The varied parameter was adjusted proportionately along the span.

A broader objective of this work is to define a matrix of aerodynamic designs for future testing that will help define the sensitivity of transonic blade rows to variation of several important design variables about which there is little available data.

The work was conducted in five phases; each consisting of the aerodynamic design of one of the five rotors. For Phase I and Phase II the location of the airfoil maximum thickness was changed from 70% of meanline length in the baseline design to 40% and 55% respectively.

The Phase III rotor was designed to have a steeper average suction surface angle in the supersonic region to reduce the Mach number ahead of the leading edge shock. This results in a smaller cascade throat area than the baseline rotor.

The Phase IV rotor was also designed to have a steeper average suction surface angle ahead of the shock but differed from the Phase III blade in that it had somewhat less external compression and somewhat more internal contraction. This reduces the rapid mean line (and suction surface) curvatures in the region of the cascade mouth. The cascade throat areas of the Phase III and Phase IV blades were essentially the same.

The Phase V blade was designed to have a somehwat smaller effective trailing edge camber than the base line rotor.

The Phase III, IV, and V all used the same airfoil thickness distribution as the base line rotor.

SECTION II

DESIGN APPROACH AND CRITERIA

It was the intent of this program to vary only one parameter at a time in the design of the new rotors, keeping other design variables as close as practical to the baseline rotor. In order to expeditiously accomplish this effort it was deemed highly desirable to reproduce the actual test results of the baseline rotor on the General Electric computer.

The test data point selected as the baseline point was the most unthrottled point available at the design speed. The measured stage pressure ratio of this point was 1.92, which is essentially the same as the design, while the measured corrected airflow of 61.36 lbm/sec was about 2 percent lower than the original design. This lower than design flow makes it possible to consider designs for Phase III and IV rotors which have smaller throat areas. The measured airflow represents a specific flow of 43.13 lbm/sec/ft^2. The measured stage efficiency was 85.4%.

The measured airflow, discharge pressures and temperatures as well as flow path and blading geometry were used in the General Electric Circumferential Average Flow Determination computer program (CAFD). Calculation stations were included within the rotor at every 10 percent of the rotor axial projection. The assumed chordwise work distribution was adjusted at each streamline until a reasonable match was obtained of the measured static pressure over the rotor tip, and the calculated throat margins, the internal blade meanline departure (deviation) angle, and the difference between the "free flow" streamline and the blade suction surface angle in the flow induction region were all reasonable when compared with past experience. This synthesis of the baseline rotor operation is referred to as the "data match" case and served as a basis to perturbate the baseline configuration to the other aerodynamic designs carried out under this contract. The data match calculations are described in greater detail in Section IV.

Since the rotor internal blade blockage of the five designs differed from the baseline rotor, the chordwise distribution of work input was adjusted for each case to make the calculated streamline static pressure distribution similar to that calculated for the baseline case. Also, the blade meanline

departure angles were adjusted so that the flow induction capacity of the blade, and the throat areas were the same as the baseline rotor (except for the Phase III and IV blades where the throat areas were intentionally changed).

The rotor leading and trailing edges were kept at the same axial projection as the baseline rotor. Since the blade stagger angle in the outer portion changed some for the 5 different rotors, the blade chords differed some from the reference blade.

The radial distribution of maximum thickness was kept the same as the baseline. Since the chords for the different designs were not identical to the baseline, there were some variations in the thickness/chord ratio.

The baseline design used a chordwise thickness distribution described in Reference 2. The thickness distribution as a function of distance along the meanline is described by two cubic equations. The first equation describes the thickness from the leading edge to the maximum thickness point, while the second defines the thickness between the point of maximum thickness and the trailing edge. The magnitude and chordwise location of the airfoil maximum thickness (as well as the leading and trailing edge thickness) are specified by the designer. The slope and curvatures are continuous at the maximum thickness location where the two equations meet. The same procedure was used for the rotors designed under this contract.

A modified version of Carter's Rule was used to calculate a reference deviation angle for the baseline rotor. This procedure converts the vector diagrams (from the data match calculations) to an equivalent two-dimensional set of vectors which would produce the same circulation as the actual blade taking into account the change in streamline radius and meridional velocity. The difference between the deviation angle implied by the data match calculations and the reference deviation angle was maintained in the design of the five rotors.

SECTION III

COMPUTATIONAL PROCEDURES

The General Electric Circumferential Average Flow Determination (CAFD) computer program was used both for the data match calculation and for the design of the rotors. This computer program is similar (but differing in detail) to that used in the design of the baseline rotor and as described in Reference 3. In both cases the "full" radial equilibrium version of the momentum equation is satisfied at each computational station, with the streamline slope and curvature being obtained by a curve fit of the calculated streamline locations. Blade circumferential blockage and blade force terms are included, determined from the stacked blade geometry and the specified chordwise work distribution, for calculation stations within a blade row. A fast convergence technique is incorporated which results in a converged solution in a relative few number of iterations.

The Streamsurface Blade Sections Program (SBS) uses CAFD intra blade station output plus a distribution of blade departure (deviation) angles and thickness between the leading and trailing edge along each streamline. Passage area distributions, throat area and choke margin are calculated for each streamsurface section.

A "free-flow" streamline is also calculated. This streamline represents the path an air particle would follow in the absence of any blade force or blade annulus blockage. An approximate suction surface Mach number is calculated for the front portion of the blade (if the flow is supersonic) by applying a Prandtl-Meyer expansion from the free-flow streamline to the blade suction surface. The average angle difference between the blade suction surface and the free flow stream-line between the leading edge and the first "captured wave" is also calculated. This is used as a guide in selecting the incidence angle and meanline shape in the flow induction region of transonic airfoils.

The blade sections generated by the SBS program are then stacked and new values of blade lean angles and annulus blockage are calculated for input to the CAFD program for the next iteration.

Two streamline sections for the base configuration and each new rotor were analyzed using the Method of Characteristics (MOC) computer program. This was

done to assure that the computed unique incidence angle was consistent with the design flow. These calculations were carried out for streamlines 10% and 40% flow from the tip.

SECTION IV

DATA MATCH OF BASELINE ROTOR

A "data match" analysis was made of a selected test data point of the baseline rotor as previously discussed in Section II. Test data for this point was received from AFAPL in reference 4 and included measured total temperature and total pressure profiles at rotor exit and stator discharge. It also includes measured casing static pressures over the rotor tip.

The flowpath geometry for the data match was extracted from reference 1 and is reproduced in Figure 1. The rotor blade geometry was basically obtained from plane section manufacturing coordinates supplied by AFWAL. These coordinates were first interpolated to stream surface coordinates and then adjusted for blade deformation due to centrifugal force and pressure loading. This adjustment for deformation was calculated by means of a finite element program used in the mechanical design and analysis of blades and vanes.

It was found that the interpolation from plane to stream surface sections introduced some irregularities near the hub. Because of this the hub section was derived directly from reference 1 and the adjacent stream surface section was somewhat smoothed to obtain a good blend.

In a "data match" analysis the CAFD circumferential average program is run with measured test data as input with, the objective of obtaining best estimates of the many aerodynamic parameters which are not measured directly. For this work, calculations were made for 13 streamlines. Calculation stations within the annulus are shown in Figure 2. Station designations were kept similar to the base line design except that additional internal rotor stations have fractional station numbers. Figures 3 and 4 show the total pressure and temperature distributions which were used at the rotor exit and stage exit stations. Also shown are the test data extracted from reference 4. As can be seen some smoothing and extrapolation of the data was required. Casing static pressures over the rotor tip cannot be input directly into the program, so matching these values is done iteratively by adjusting the chordwise distribution of rotor work input. The assumed boundary layer allowance is shown on Figure 5. The same boundary layer allowance was specified at each streamline at a given calculation station. Figure 6 shows both the measured and "data

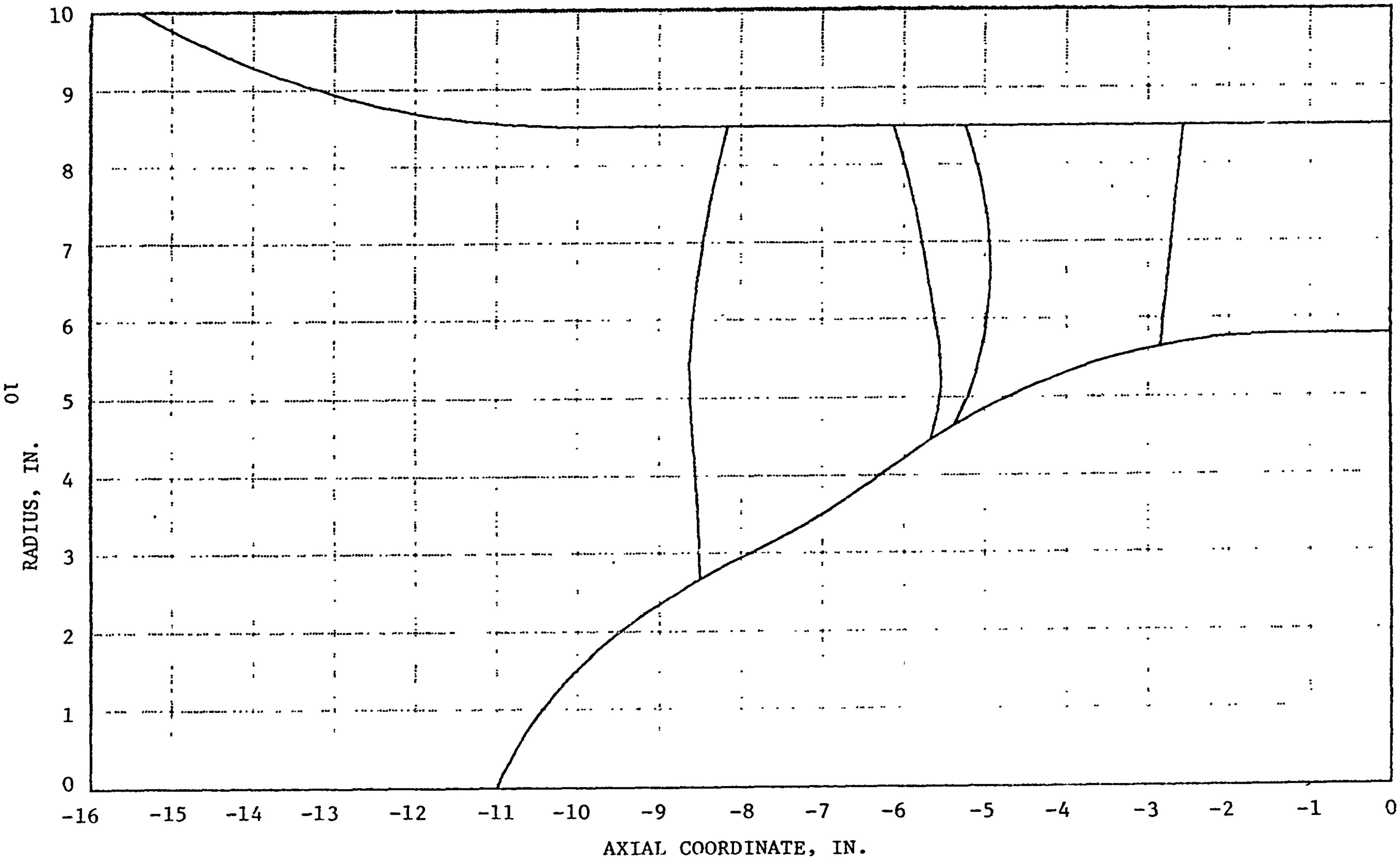

Figure 1. Compressoı Flowpath With Blade Edge Stations

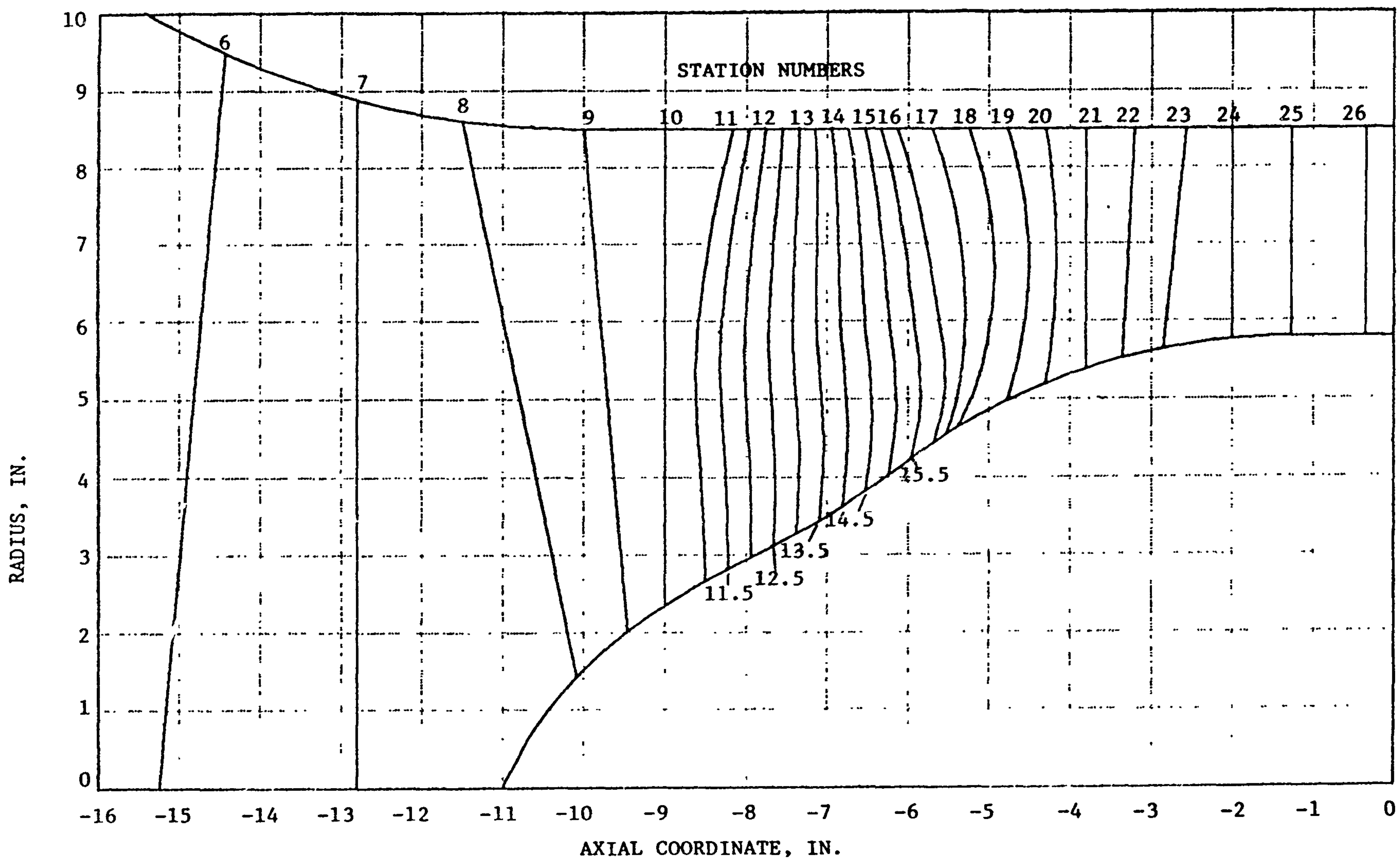

Figure 2. Compressor Flowpath With Calculation Stations

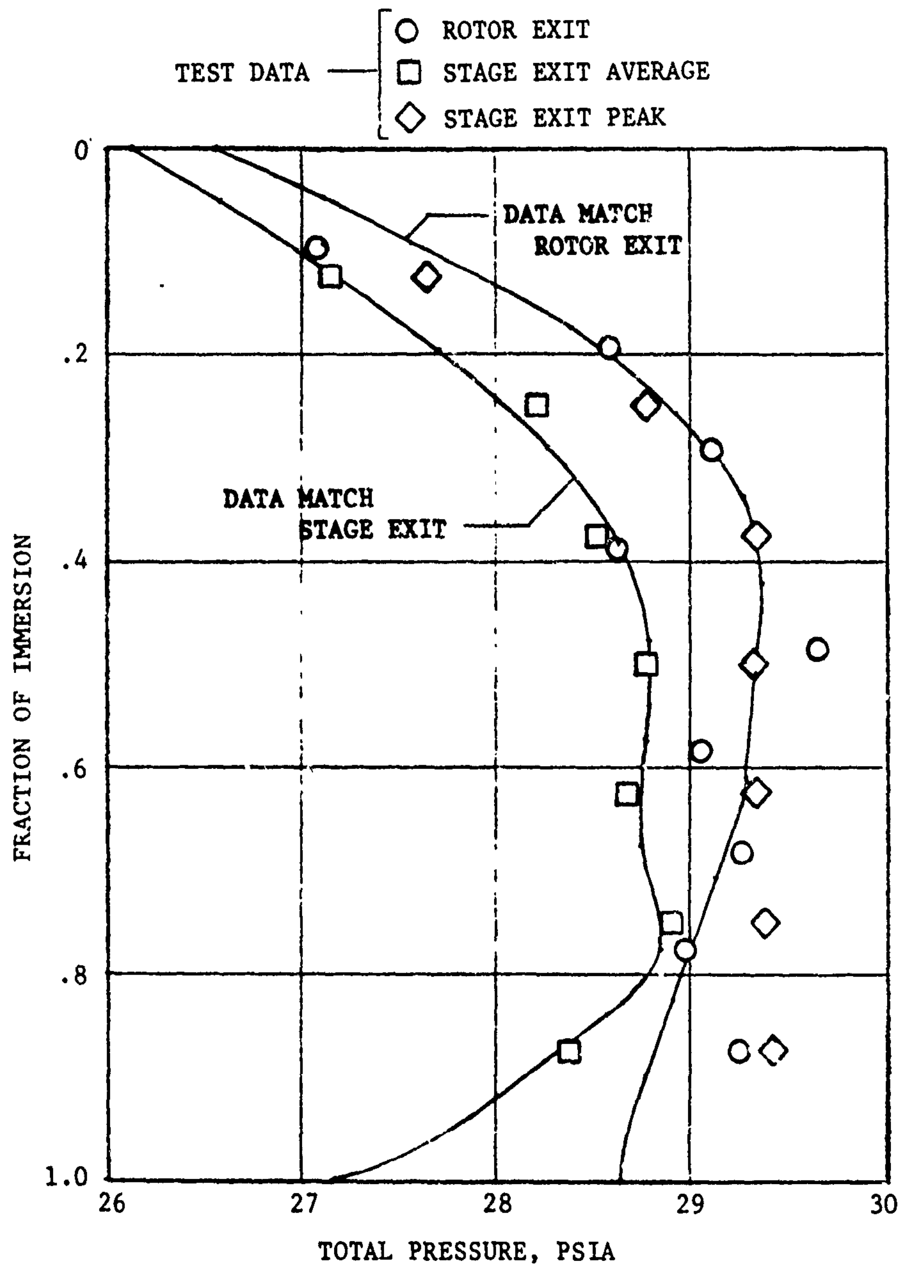

Figure 3. Data Match Total Pressures at Rotor Exit and at Stage Exit Compared with Measured Data

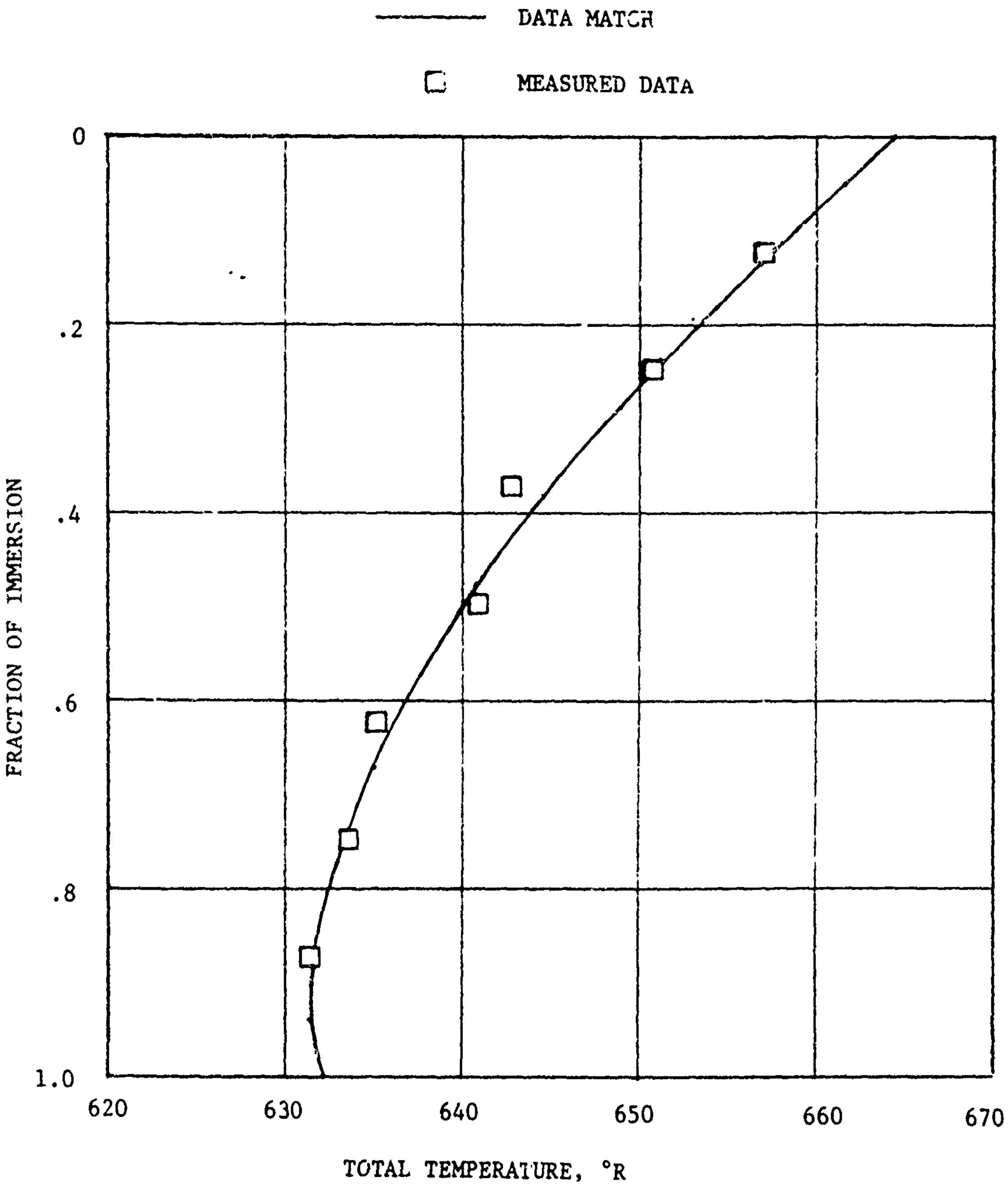

Figure 4. Data Match Total Temperatures at Stage Exit Compared With Measured Data

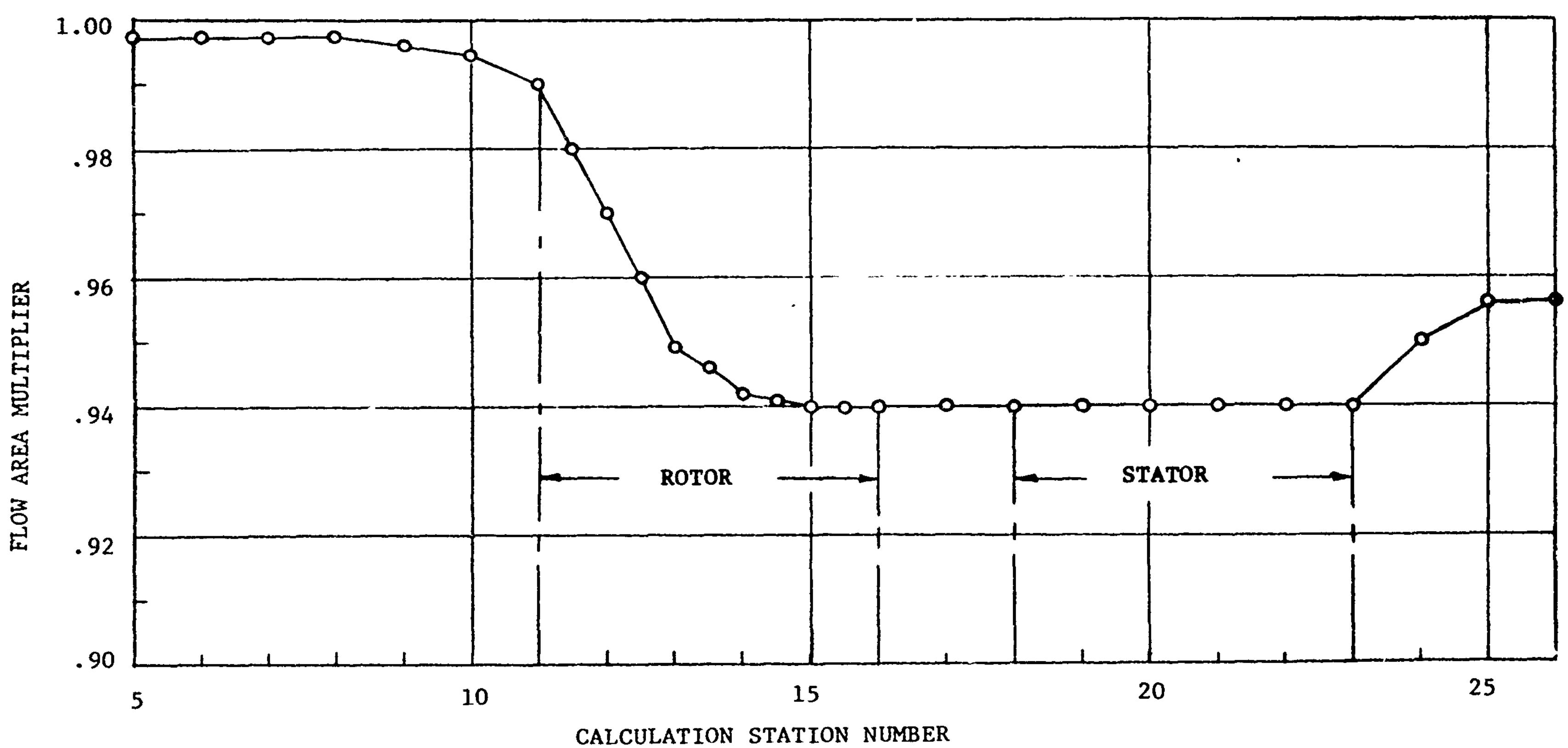

Figure 5. Multiplier On Flow Area Used To Account For Assumed Boundary Layer Displacement Thicknesses

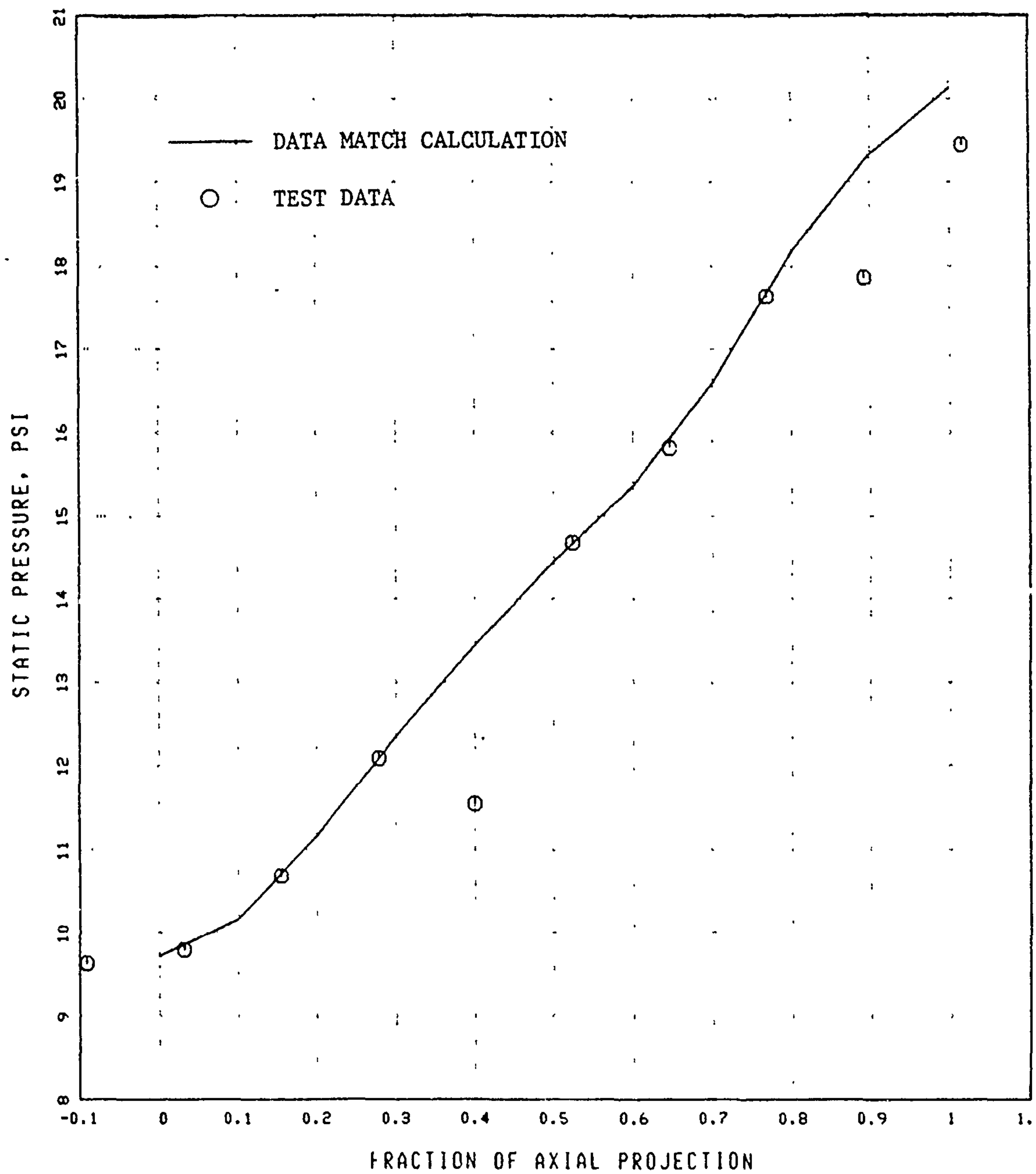

Figure 6. Data Match Rotor Static Pressure Distribution

match" casing static pressures. As can be seen, a perfect match could not be achieved. In particular, three measured casing stations appear to be lower than the corresponding data match values. No explanation for this has been determined.

The overall radial distribution of rotor work input was defined by the radial distribution of the total temperature at the rotor trailing edge station. Radial distribution of the rotor work input at the internal blade stations however is not so defined. At the internal rotor blade stations, the radial distribution of work input was iteratively adjusted so as to result in reasonable departure angle distributions along the blade span. Departure angle is here defined as the difference between the blade meanline angle and the air angle on a stream surface. The assumed streamline work input (as a fraction of the total streamline work) is plotted versus percent axial projection in Figure 7. The tip streamline is the one on the left. Each subsequent streamline is indexed to the right by the value of its stream function (fraction of the total flow from the tip). The dashed lines are lines of constant fraction of axial projection. A plot of departure angle on each data match streamline is shown in Figure 8.

The input stage work distribution and total pressure distributions at the rotor exit and stage exit imply blade row pressure loss coefficients. These pressure loss coefficients are shown in Figures 9 and 10 for the rotor and stator respectively. Rotor and overall stage efficiency distributions are also implied by the input work and total pressure distributions. These adiabatic efficiencies for the rotor and overall stage are shown in Figures 11 and 12 respectively.

After a satisfactory data match was obtained with the CAFD program, the SBS program was run to calculate various aerodynamic parameters including the several passage area ratios on each stream surface. Also a method of characteristics program called "MOC" was run on SBS streamlines 2 and 5 to serve as a later basis for assuring that the rotors to be designed under this contract would achieve the same flow as the base line rotor.

Figure 13 shows the rotor throat margin versus immersion. As here defined, the throat margin for a streamsurface blade section is the percent

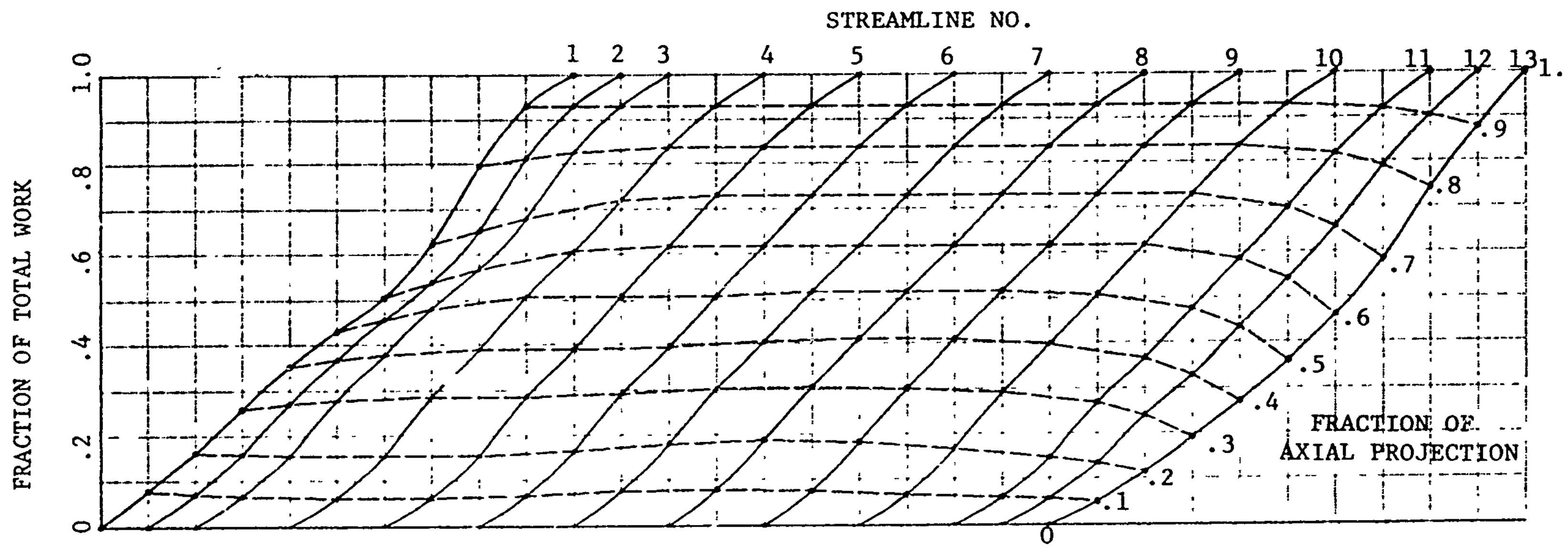

Figure 7. Data Match Rotor Intrablade Work Distribution

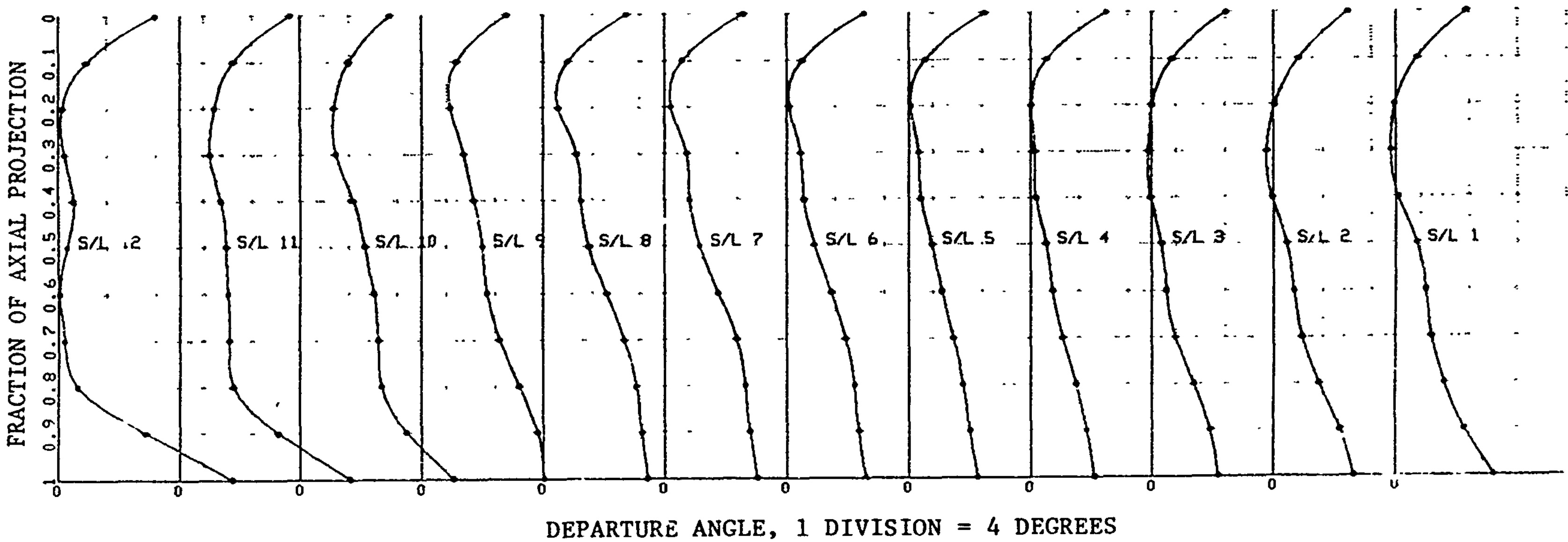

Figure 8. Data Match Rotor Intrablade Departure Angle Distribution

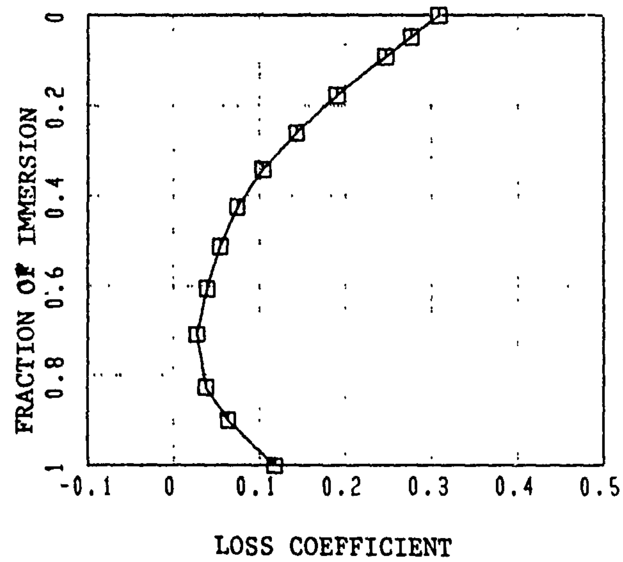

Figure 9. Data Match Rotor Total Pressure Loss Coefficient Versus Fractional Immersion

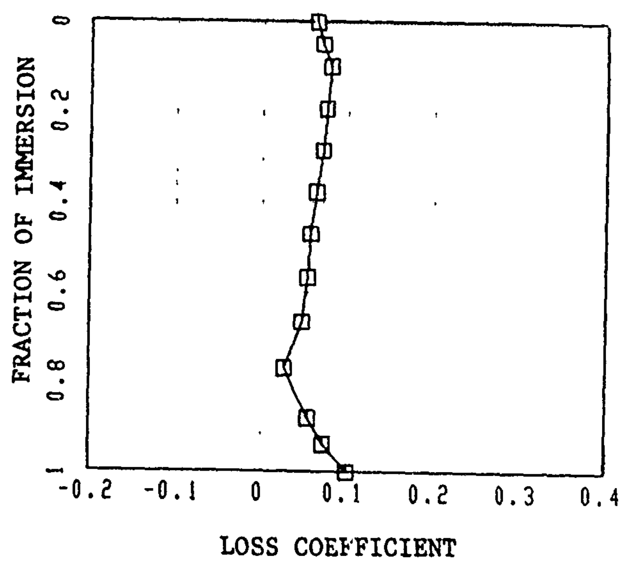

Figure 10. Data Match Stator Total Pressure Loss Coefficient Versus Fractional Immersion

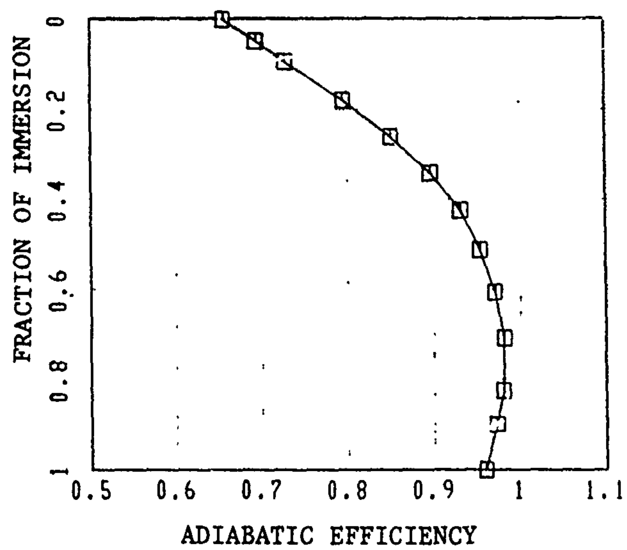

Figure 11. Data Match Rotor Efficiency
Versus Fractional Immersion

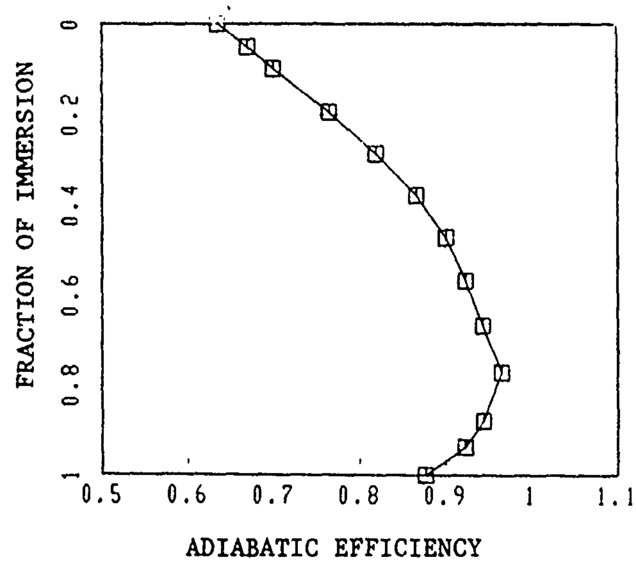

Figure 12. Data Match Stage Efficiency
Versus Fractional Immersion

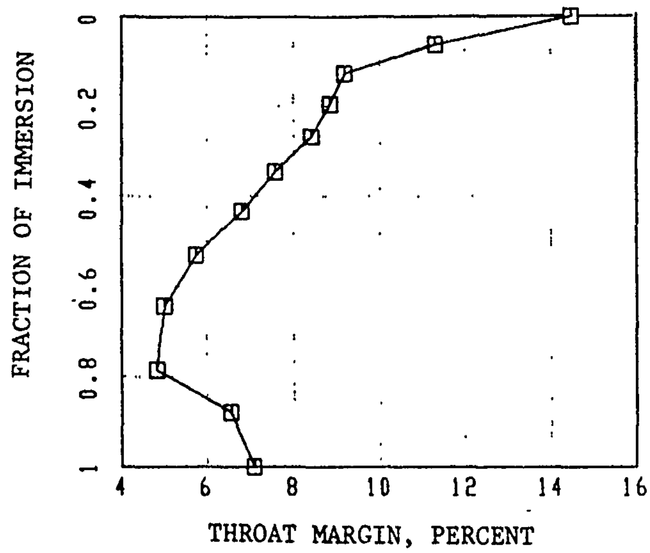

Figure 13. Data Match Rotor Throat Margin
Versus Fractional Immersion

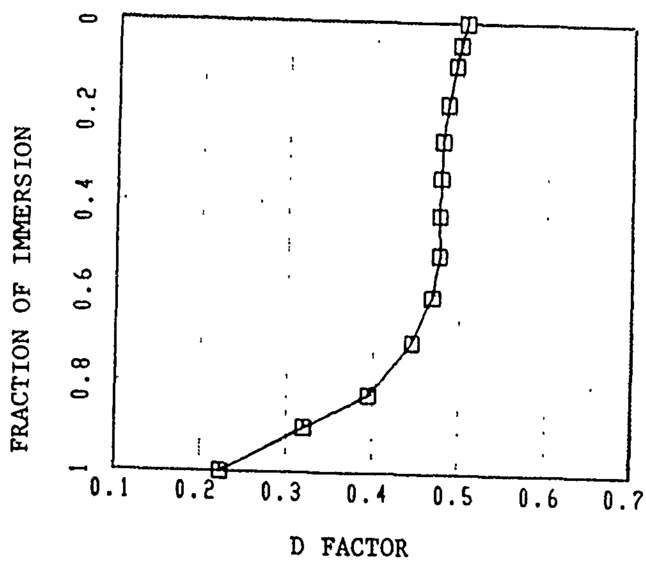

Figure 14. Data Match Rotor D Factor
Versus Fractional Immersion

excess throat area over and above the minimum theoretical area required to pass the streamtube flow at a throat Mach number of 1.0 and assuming a total pressure loss equivalent to one normal shock at the upstream Mach number. In a rotor, the effect of radius change (between the leading edge and throat) on the relative total enthalpy and pressure is included. Throat margin distributions for Phase I, II, and V rotors were kept nearly identical to the data match case. For Phase III and IV rotors, it was intentionally different.

Figure 14 shows the rotor Lieblein Diffusion Faction (D factor) versus immersion.

Figures 15 and 16 show the data match rotor incidence and deviation angles respectively. Here the incidence and deviation angles are defined as seen in a streamsurface section. The irregularity in the incidence angle shown in Figure 15 near the hub may be the result of interpolating from the plane section coordinates of the baseline rotor.

A modified version of Carter's Rule was used to calculate a reference deviation angle for the baseline rotor. This procedure converts the vector diagrams (from the data match calculations) to an equivalent two-dimensional set of vectors which would produce the same circulation as the actual blade taking into account the change in streamline radius and meriodional velocity. The difference between the deviation angle implied by the data match calculations and the reference deviation angle is shown in Figure 17. This "delta deviation angle" was used as a guide in setting deviation angles for the other five rotor designs.

Figure 18 shows the stator incidence angle implied by the data match calculations and the baseline stator geometry. Since the other five rotor designs will be tested with this same stator, it is important that their design stator incidence angles do not depart too greatly from the data match case.

The detail results of the data match analysis are given in Section V.

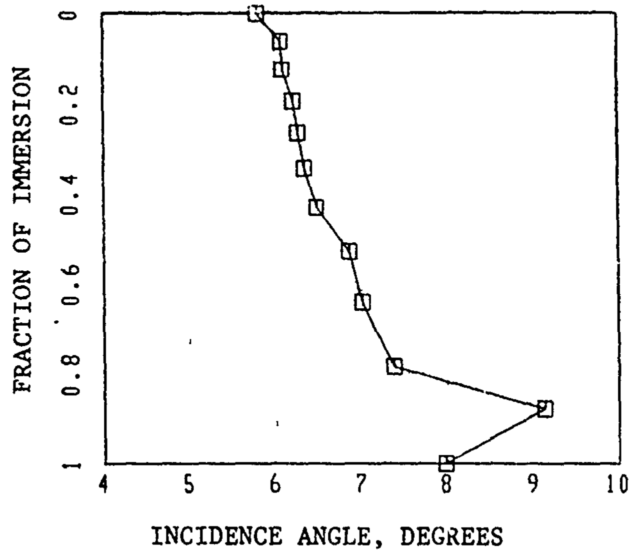

Figure 15. Data Match Rotor Incidence Angle Versus Fractional Immersion

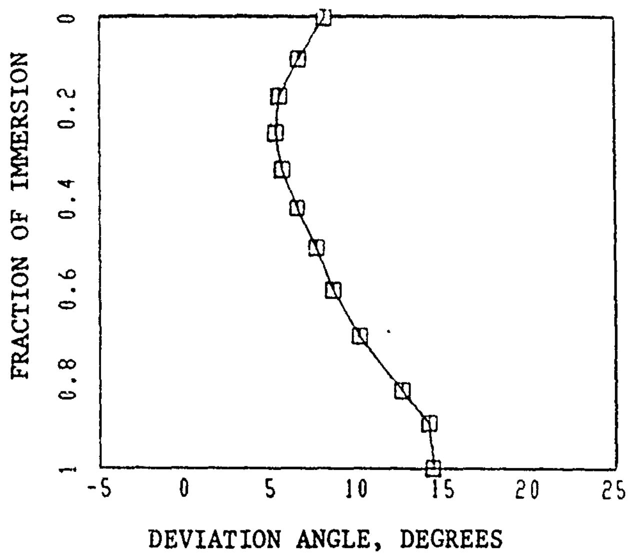

Figure 16. Data Match Rotor Deviation Angle Versus Fractional Immersion

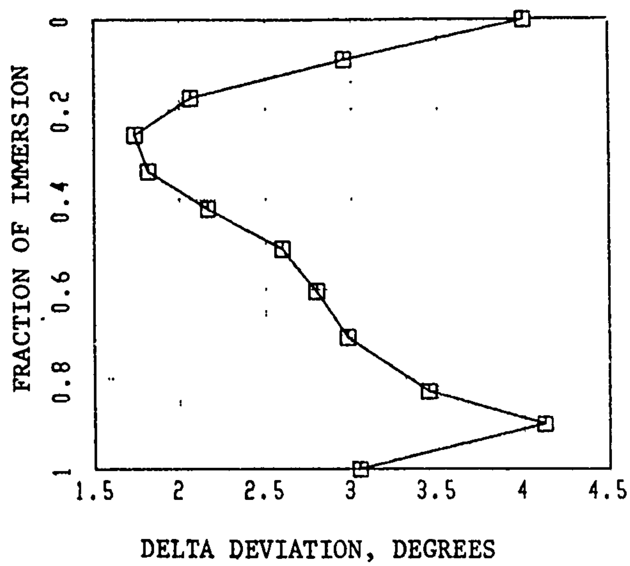

Figure 17. Data Match Rotor Deviation Angle Minus Reference Deviation Angle

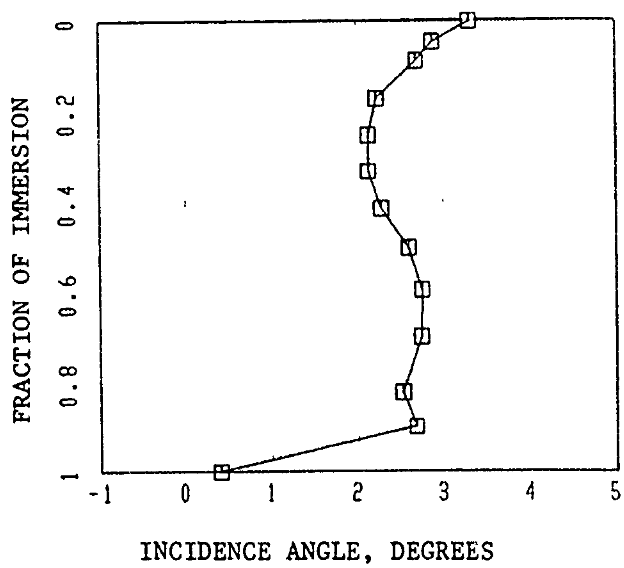

Figure 18. Data Match Stator Incidence Angle Versus Fractional Immersion

SECTION V

DETAIL RESULTS OF DATA MATCH

The following tabulation presents the detail results of the data match circumferential average flow computation. Each page of the tabulation gives results for one calculation station. Figure 2 shows the calculation station locations within the flowpath. At each calculation station various aerodynamic parameters are given on each of thirteen calculation streamlines. Also given are several mass averaged station flow properties.

INLET   STA= 5.000   FREE
I= 1   MTIP= 1   AFLOW= 478.13   D*C=O.   D*H=O.
WTF= 61.365   OPTX=DPP   OPTY=FREE   ITYPE=O   INBR=O   ABC=O.   ABH=O.

PSIC	Z	R	PHI	CURV	VM	CU	ALPHAM	MM
0.	-18.800	13.207	-50.10	0 0831	150.4	0.	0.	0.135
0.050	-18.800	12.564	-43.54	0.	181.0	0.	0.	0.163
0.100	-18.800	12.020	-40.31	0.	195.9	0.	0.	0.176
0.200	-18.800	11.027	-34.70	0.	218.6	0.	0.	0.196
0.300	-18.800	10.099	-29.90	0.	237.1	0.	0.	0.213
0.400	-18.800	9.193	-25.65	0.	252.4	0.	0.	0.227
0.500	-18.800	8.277	-21.78	0.	265.1	0.	0.	0.239
0.600	-18.800	7.319	-18.16	0.	275.9	0.	0.	0.248
0.700	-18.800	6.277	-14.68	0.	284.9	0.	0.	0.257
0.800	-18.800	5.083	-11.18	0.	292.5	0.	0.	0.264
0.900	-18.800	3.569	-7.34	0.	298.9	0.	0.	0.270
0.950	-18.800	2.516	-4.91	0.	301.6	0.	0.	0.272
1.000	-18.800	0.000	0.	0.	303.9	0.	0.	0.274

SL	BLDBLK	PS	PT	TT	BETAM	VREL	MREL	VABS	MABS
1	0.997	14.510	14.696	518.7	86.31	2335.4	2.095	150.4	0.135
2	0.997	14.427	14.696	518.7	85.33	2224.5	1.997	181.0	0.163
3	0.997	14.382	14.696	518.7	84.72	2130.2	1.913	195.9	0.176
4	0.997	14.305	14.696	518.7	83.59	1958.1	1.760	218.6	0.196
5	0.997	14.237	14.696	518.7	82.42	1797.9	1.617	237.1	0.213
6	0.997	14.177	14.696	518.7	81.16	1641.9	1.477	252.4	0.227
7	0.997	14.124	14.696	518.7	79.71	1484.6	1.337	265.1	0.239
8	0.997	14.077	14.696	518.7	77.94	1320.6	1 190	275 9	0.248
9	0.997	14.037	14.696	518.7	75.58	1143.7	1 031	284.9	0.257
10	0.997	14.002	14.696	518.7	71.94	943.5	0.850	292.5	0.264
11	0.997	13.972	14.696	518.7	64.61	697.2	0.629	298.9	0.270
12	0.997	13.959	14.696	518.7	55.81	536 8	0.484	301.6	0 272
13	0.997	13.947	14.696	518.7	0.00	303.9	0.274	303.9	0.274

STA 5.000 MASS AVERAGED PROPERTIES
PT= 14.696   TT= 518.69   GAMMA=1.4015   PT-RAT= 1.000   TT-RAT= 1.000
RCU= 0.   VM= 255.3   CZ= 233.4   MM=0.230   MABS=0.230   MREL=1.300

INLET STA= 6.000 FREE

I= 2 MTIP= 14 AFLOW= 277.56 D*C=0. D*H=0.

WTF= 61 365 OPTX=DPP OPTY=FREE ITYPE=0 INBR=0 ABC=0. ABH=0

PSIC	Z	R	PHI	CURV	VM	CU	ALPHAM	MM
0	-14.431	9.481	-24 96	-0.0952	514 6	0.	0.	0.471
0.050	-14.450	9.254	-24.10	-0.1028	507.6	0.	0.	0.464
0.100	-14.470	9.020	-22.95	-0.0955	501.1	0.	0.	0.458
0 200	-14.513	8.532	-20.65	-0.0825	489.4	0.	0.	0.447
0.300	-14.558	8.010	-18.38	-0.0712	478.4	0.	0	0.436
0.400	-14.606	7.446	-16.13	-0.0614	467.8	0	0.	0 426
0 500	-14.660	6.829	-13.87	-0.0529	457.2	0.	0.	0.416
0.600	-14.719	6.141	-11.59	-0.0455	446.4	0.	0	0.406
0.700	-14.787	5.352	-9.23	-0.0390	434.9	0.	0.	0.395
0 800	-14.869	4.403	-6.73	-0 0330	422.1	0	0.	0.383
0.900	-14.978	3.142	-4.03	-0.0257	407.0	0.	0.	0.369
0 950	-15.057	2.235	-2.57	-0.0189	398.2	0.	0.	0.361
1.000	-15.250	-0.000	0.	0	387.2	0.	0.	0.351

SL	BLDBLK	PS	PT	TT	BETAM	VREL	MREL	VABS	MABS
1	0.997	12.623	14.696	518.7	72.90	1750.4	1.601	514.6	0.471
2	0.997	12.677	14.696	518 7	72 73	1710.1	1.564	507.6	0.464
3	0.997	12.726	14.696	518.7	72.53	1668.8	1 525	501.1	0.458
4	0.997	12.812	14.696	518.7	71.99	1583.2	1.445	489.4	0.447
5	0.997	12.892	14.696	518 7	71.30	1492 2	1.361	478.4	0.436
6	0.997	12.968	14.696	518.7	70.41	1394.8	1.271	467.8	0.426
7	0.997	13.042	14.696	518.7	69.22	1288.9	1.174	457.2	0.416
8	0.997	13.116	14.696	518.7	67.61	1172 0	1.066	446.4	0.406
9	0.997	13.193	14.696	518.7	65.27	1039.7	0.945	434 9	0.395
10	0.997	13.277	14.696	518.7	61.48	884.2	0.803	422.1	0.383
11	0.997	13.374	14.696	518.7	53.72	687.8	0.624	407.0	0 369
12	0.997	13.428	14.696	518.7	44.72	560.4	0.508	398.2	0.361
13	0.997	13.495	14.696	518.7	-0.00	387.2	0.351	387.2	0.351

STA 6.000 MASS AVERAGED PROPERTIES

PT= 14.696 TT= 518.69 GAMMA=1.4016 PT-RAT= 1.000 TT-RAT= 1.000

RCU= 0. VM= 455.5 CZ= 438.5 MM=0.415 MABS=0.415 MREL=1.120

```
INLET                           STA=  7.000                              FREE
                     I= 3       MTIP= 27     AFLOW=  244.35     D*C=0.        D*H=0.
WTF=  61.365    OPTX=OPP     OPTY=FREE   ITYPE=0  INBR=0  ABC=0.          ABH=0.
```

PSIC	Z	R	PHI	CURV	VM	CU	ALPHAM	MM
0.	-12.800	8.880	-15.47	-0.0952	625.2	0.	0.	0.578
0.050	-12.800	8.675	-14.65	-0.0872	617.8	0.	0.	0 571
0.100	-12.800	8.464	-13.90	-0.0849	610.4	0.	0.	0.564
0.200	-12.800	8.021	-12.40	-0.0794	595.1	0.	0.	0.549
0.300	-12.800	7.546	-10.87	-0.0736	579.6	0.	0.	0.533
0.400	-12.800	7.032	-9.28	-0.0680	563.9	0.	0.	0.518
0.500	-12.800	6.468	-7.60	-0.0629	547.6	0.	0.	0.502
0.600	-12.800	5.837	-5.79	-0.0587	530.4	0.	0.	0.486
0.700	-12.800	5.112	-3.79	-0.0560	511.3	0.	0.	0.468
0.800	-12.800	4.237	-1.46	-0.0558	488 4	0.	0.	0.446
0.900	-12.800	3.064	1 52	-0 0634	455.9	0	0.	0.415
0.950	-12.800	2.206	3.54	-0.0760	428.6	0.	0.	0 390
1.000	-12.800	0.000	0	0.	383.5	0.	0.	0.347

SL	BLDBLK	PS	PT	TT	BETAM	VREL	MREL	VABS	MABS
1	0.998	11.715	14.696	518.7	68.25	1687.2	1.560	625.2	0.578
2	0.998	11.779	14.696	518.7	68.02	1650.8	1.525	617.8	0.571
3	0.998	11.843	14.696	518.7	67.77	1613.5	1.490	610.4	0.564
4	0.998	11.974	14.696	518.7	67.20	1535.5	1.415	595.1	0.549
5	0.998	12.105	14.696	518.7	66.48	1452.4	1.337	579.6	0.533
6	0.998	12.235	14.696	518.7	65.56	1363.1	1.253	563.9	0.518
7	0.998	12.366	14.696	518.7	64.37	1266.0	1.162	547.6	0.502
8	0.998	12.502	14.696	518.7	62.76	1158.6	1.061	530.4	0.486
9	0.998	12.649	14.696	518.7	60.46	1036.9	0.948	511.3	0.468
10	0.998	12.819	14.696	518.7	56.85	893.1	0.815	488.4	0.446
11	0.998	13.051	14.696	518.7	49.87	707.2	0.644	455.9	0.415
12	0.998	13.234	14.696	518.7	42.25	579.1	0.526	428.6	0.390
13	0.998	13.517	14.696	518.7	0.00	383.5	0.347	383.5	0.347

```
                  STA    7.000  MASS AVERAGED PROPERTIES
PT= 14.696   TT= 518.69   GAMMA=1.4017   PT-RAT= 1.000   TT-RAT=  1.000
RCU=      0.    VM= 539.1   CZ= 532.1   MM=0 495   MABS=0.495   MREL=1.109
```

INLET STA= 8.000 FREE

I= 4 MTIP= 40 AFLOW= 224.07 D*C=0. D*H=C.

WTF= 61.365 OPTX=DPP OPTY=FREE ITYPE=0 INBR=0 ABC=0. ABH=0.

PSIC	Z	R	PHI	CURV	VM	CU	ALPHAM	MM
0.	-11.499	8.608	-8.21	-0.0953	712.0	0.	0.	0.665
0.050	-11.461	8.412	-7 49	-0.0964	703.2	0.	0.	0.656
0.100	-11.421	8.211	-6.86	-0.0909	693.7	0.	0.	0.647
0.200	-11.339	7.790	-5.59	-0.0815	675.7	0.	0.	0.628
0.300	-11.250	7.341	-4.25	-0.0744	658.7	0.	0.	0.611
0.400	-11.155	6.853	-2.77	-0.0695	642.1	0.	0.	0.595
0.500	-11.052	6.333	-1.10	-0.0668	625.0	0.	0.	0.578
0.600	-10.938	5.753	0.90	-0.0667	606.2	0.	0.	0.559
0.700	-10.809	5.096	3.37	-0 0696	583.8	0.	0.	0.538
0.800	-10.656	4.320	6.69	-0.0768	554.5	0.	0	0.509
0.900	-10.459	3.318	12.10	-0.0934	510.5	0.	0	0.467
0.950	-10.323	2.629	17.75	-0.1212	468.1	0.	0.	0 427
1.000	-10.086	1.421	47.99	0.1910	433.9	0.	0.	0.394

SL	BLDBLK	PS	PT	TT	BETAM	VREL	MREL	VABS	MABS
1	0.997	10.920	14.696	518.7	64.89	1677.6	1.567	712.0	0.665
2	0.997	11.003	14.696	518.7	64.65	1642.6	1.533	703.2	0.656
3	0.997	11.092	14.696	518.7	64.42	1606.4	1.497	693.7	0.647
4	0.997	11.260	14.696	518.7	63.82	1531.8	1.424	675.7	0.628
5	0.997	11.415	14.696	518.7	63.05	1453.3	1.349	658.7	0.611
6	0.997	11.565	14.696	518.7	62.05	1370.1	1.269	642.1	0 595
7	0.997	11.716	14.696	518.7	60.78	1280.6	1.184	625.0	0.578
8	0.997	11.879	14.696	518.7	59.16	1182.5	1.091	606.2	0.559
9	0.997	12.069	14.696	518.7	57.01	1072.2	0.987	583.8	0.538
10	0.997	12.311	14.696	518.7	53.97	942.6	0.866	554.5	0.509
11	0.997	12.654	14.696	518.7	48.91	776.8	0.710	510.5	0.467
12	0.997	12.966	14.696	518.7	44.75	659.0	0.601	468.1	0.427
13	0.997	13.199	14.696	518.7	30.02	501.2	0.456	433.9	0.394

STA 8.000 MASS AVERAGED PROPERTIES

PT= 14.696 TT= 518.69 GAMMA=1.4017 PT-RAT= 1.000 TT-RAT= 1.000

RCU= 0. VM= 612.1 CZ= 604.7 MM=0.566 MABS=0.566 MREL=1.140

```
INLET                          STA=  9 000                                    FREE
                I= 5           MTIP= 53     AFLOW=  211.87    D*C=O.       D*H=O
WTF=  61.365   OPTX=DPP       OPTY-FREE   ITYPE=O  INBR=O  ABC=O.        ABH=O.
```

PSIC	Z	R	PHI	CURV	VM	CU	ALPHAM	MM
0.	-9.999	8.500	0.	0	758 6	0.	0.	0 713
0.050	-9.984	8.315	-1.11	-0.0542	751.6	0.	0.	0.706
0.100	-9.968	8.125	-0.88	-0.0525	743.7	0.	0.	0.697
0.200	-9.935	7.728	-0.27	-0.0507	729 9	0.	0.	0.683
0.300	-9.900	7.305	0.60	-0.0510	715.8	0.	0.	0.669
0.400	-9.862	6.851	1.76	-0.0530	700.5	0.	0.	0.653
0 500	-9.821	6.359	3.28	-0.0573	682.8	0.	0.	0.635
0.600	-9.776	5.816	5.23	-0.0634	661.0	0.	0.	0.614
0.700	-9.725	5.201	7.76	-0.0714	633.1	0.	0.	0.586
0.800	-9.665	4.475	11.17	-0.0793	596.3	0.	0.	0.550
0.900	-9.587	3.542	16.58	-0.0807	546.2	0.	0.	0.501
0.950	-9.536	2.919	21.63	-0.0405	515.5	0.	0.	0.472
1.000	-9.460	2.011	38.65	0.1881	511.6	0.	0.	0.468

SL	BLDBLK	PS	PT	TT	BETAM	VREL	MREL	VABS	MABS
1	0.996	10.469	14.696	518.7	63.17	1680.9	1.580	758.6	0.713
2	0.996	10.537	14.696	518.7	62.88	1648.6	1.548	751.6	0.706
3	0.996	10.615	14.696	518.7	62.59	1615.2	1.515	743.7	0.697
4	0.996	10.748	14.696	518.7	61.84	1546.7	1.448	729.9	0.683
5	0.996	10.883	14.696	518.7	60.96	1474.5	1.378	715.8	0.669
6	0.996	11.028	14.696	518.7	59.91	1397.3	1.303	700.5	0.653
7	0.996	11.194	14.696	518.7	58.68	1313.6	1.223	682.8	0.635
8	0.996	11.394	14.696	518.7	57.22	1220 8	1.133	661.0	0.614
9	0.996	11.645	14.696	518.7	55.40	1115.0	1.032	633.1	0.586
10	0.996	11.964	14.696	518.7	52.94	989.6	0.912	596.3	0.550
11	0.996	12.377	14.696	518.7	48.85	830.0	0.762	546.2	0.501
12	0.996	12.617	14.696	518.7	44.98	728.8	0.667	515.5	0.472
13	0.996	12.647	14.696	518.7	34.75	622.6	0.569	511.6	0.468

```
                STA    9.000  MASS AVERAGED PROPERTIES
PT= 14.696   TT= 518.69  GAMMA=1.4018  PT-RAT= 1.000  TT-RAT=  1.000
RCU=     0.    VM= 663.8  CZ= 655.3  MM=0.617  MABS=0.617  MREL=1.178
```

INLET STA= 10.000 FREE

I= 6 MTIP= 66 AFLOW= 204.14 D*C=0 D*H=0

WTr= 61.365 OPTX=DPP OPTY=FREE ITYPE=0 INBR=0 ABC=0 ABH=0.

PSIC	Z	R	PHI	CURV	VM	CU	ALPHAM	MM
0.	-9.000	8.500	0	0.	773 6	0.	0	0.728
0.050	-9.000	8.317	0.34	0 0029	773.8	0.	0.	0.729
0 100	-9.000	8.130	0.63	-0.0022	773.8	0.	0.	0.729
0.200	-9.000	7.742	1.41	-0.0120	771.3	0.	0.	0 726
0.300	-9.000	7.333	2.45	-0.0206	765.2	0.	0.	0.720
0.400	-9.000	6.896	3.82	-0.0302	755 0	0	0.	0.709
0.500	-9.000	6.424	5.59	-0.0406	739.4	0.	0.	0.693
0.600	-9 000	5.906	7.91	-0.0566	715.9	0.	0	0.669
0.700	-9.000	5.320	10.82	-0.0740	681.5	0	0.	0.634
0.800	-9.000	4.625	14.43	-0.0876	634.3	0.	0.	0.587
0.900	-9.000	3.733	19.52	-0.0856	574.8	0.	0	0 529
0 950	-9.000	3.141	23 66	-0 0817	535.9	0.	0	0.491
1.000	-9.000	2.340	32.46	0.1922	544.2	0.	0.	0.499

SL	BLDBLK	PS	PT	TT	BETAM	VREL	MREL	VABS	MABS
1	0.994	10.321	14.696	518.7	62.72	1687.7	1.589	773.6	0.728
2	0.994	10.318	14.696	518.7	62.20	1659.2	1.562	773 8	0.729
3	0.994	10.318	14.696	518.7	61.66	1630.1	1.535	773.8	0.729
4	0.994	10.343	14.696	518.7	60.55	1568.9	1.477	771.3	0.726
5	0.994	10.403	14.696	518.7	59.40	1503.3	1.414	765.2	0.720
6	0.994	10.504	14.696	518.7	58.18	1432.1	1.345	755.0	0.709
7	0.994	10.656	14.696	518.7	56.89	1353.6	1.269	739.4	0.693
8	0.994	10.882	14.696	518.7	55.51	1264.5	1.182	715.9	0.669
9	0.994	11.206	14.696	518.7	54.02	1160.1	1.080	681.5	0.634
10	0.994	11.634	14.696	518.7	52.15	1033.7	0.957	634.3	0.587
11	0.994	12.145	14.696	518.7	48.89	874.3	0.804	574.8	0.529
12	0.994	12.459	14.696	518.7	45.97	771.0	0.707	535.9	0.491
13	0.994	12.393	14.696	518.7	37.19	683.1	0.627	544.2	0.499

STA 10.000 MASS AVERAGED PROPERTIES

PT= 14.696 TT= 518.69 GAMMA=1.4018 PT-RAT= 1.000 TT-RAT= 1.000

RCU= 0. VM= 705.8 CZ= 694 5 MM=0.660 MABS=0.660 MREL=1.217

ROTOR1 STA= 11.000 LE ROTOR

I= 7 MTIP= 79 AFLOW= 197.41 D*C=0. D*H=0.

WTF= 61.365 OPTX=DPP OPTY=FREE ITYPE=4 INBR=3 ABC=0. ABH=0.

PSIC	Z	R	PHI	CURV	VM	CU	ALPHAM	MM
0.	-8.166	8.500	0.	0.	832.8	0	0.	0.791
0.050	-8.204	8.322	0.36	-0.0040	834.5	0.	0.	0.793
0.100	-8.242	8.140	0.74	-0.0026	835.6	0.	0.	0.794
0.200	-8.322	7.762	1.72	-0.0036	835.7	0.	0.	0.794
0.300	-8.397	7.362	3.00	-0.0113	830.5	0.	0.	0.788
0.400	-8.466	6.936	4.60	-0.0206	818.7	0.	0.	0.776
0.500	-8.531	6.475	6.64	-0.0372	798.1	0.	0.	0.754
0.600	-8.592	5.968	9.21	-0.0526	765.5	0.	0.	0.720
0.700	-8.624	5.397	12.37	-0.0666	721.0	0.	0.	0.674
0.800	-8.604	4.735	16.27	-0.0684	668.5	0.	0.	0.621
0.900	-8.548	3.903	21.64	-0.0674	602.3	0.	0.	0.556
0.950	-8.526	3.360	25.82	-0.0627	558.9	0.	0.	0.513
1.000	-8.507	2.653	31.20	0.1471	554.4	0.	0.	0.509

SL	BLDBLK	PS	PT	TT	BETAM	VREL	MREL	VABS	MABS
1	0.990	9.723	14.696	518.7	60.96	1715.7	1.629	832.8	0.791
2	0.990	9.706	14.696	518.7	60.39	1689.1	1.605	834.5	0.793
3	0.990	9.694	14.696	518.7	59.81	1661.8	1.579	835.6	0.794
4	0.990	9.693	14.696	518.7	58.61	1604.5	1.524	835.7	0.794
5	0.990	9.747	14.696	518.7	57.41	1541.9	1.464	830.5	0.788
6	0.990	9.867	14.696	518.7	56.22	1472.5	1.396	818.7	0.776
7	0.990	10.075	14.696	518.7	55.07	1393.8	1.317	798.1	0.754
8	0.990	10.401	14.696	518.7	53.99	1301.9	1.225	765.5	0.720
9	0.990	10.834	14.696	518.7	52.87	1194.6	1.117	721.0	0.674
10	0.990	11.326	14.696	518.7	51.34	1070.1	0.994	668.5	0.621
11	0.990	11.913	14.696	518.7	48.84	915.0	0.844	602.3	0.556
12	0.990	12.275	14.696	518.7	46.69	814.9	0.749	558.9	0.513
13	0.990	12.312	14.696	518.7	40.18	725.6	0.666	554.4	0.509

STA 11.000 MASS AVERAGED PROPERTIES

PT= 14.696 TT= 518.69 GAMMA=1.4018 PT-RAT= 1.000 TT-RAT= 1.000

RCU= 0. VM= 756.0 CZ= 741.7 MM=0.712 MABS=0.712 MREL=1.260

ROTOR1 STA= 11.500 IN ROTOR

I= 8 MTIP= 92 AFLOW= 181.11 D*C=0 D*H=0.

WTF= 61.365 OPTX=TT OPTY=PT ITYPE=5 INBR=3 ABC=0. ABH=0.

PSIC	Z	R	PHI	CURV	VM	CU	ALPHAM	MM
0.	-7.963	8.500	0	0	847.8	44.8	3.03	0.797
0.050	-7.991	8.323	0.22	0.0264	851.4	40.5	2.72	0.802
0.100	-8.020	8.142	0.56	0.0298	859.4	38.3	2.55	0.812
0.200	-8.083	7.769	1.51	0.0191	876.2	36.5	2.38	0.830
0.300	-8.143	7.376	3.07	0.0025	886.3	37.1	2.40	0.841
0.400	-8.198	6.958	4.86	-0.0135	886.4	40.3	2.61	0.841
0.500	-8.251	6.509	7.07	-0.0166	878.6	47.8	3.12	0.832
0.600	-8.301	6.017	9.72	-0.0088	854.8	51.7	3.46	0.807
0.700	-8.324	5.466	12.93	0.0027	819.7	53.6	3.74	0.770
0.800	-8.299	4.827	16.85	0.0046	772.0	52.8	3.91	0.721
0.900	-8.247	4.026	22.16	0.0115	709.7	57.0	4.59	0.658
0.950	-8.231	3.505	25.84	0.0596	676.5	62.3	5.26	0.625
1.000	-8.224	2.817	29.07	0.0800	652.5	69.0	6.04	0.602

SL	BLDBLK	PS	PT	TT	BETAM	VREL	MREL	VABS	MABS
1	0.955	10.156	15.467	529.9	59.77	1684.2	1.584	849.0	0.799
2	0.955	10.074	15.414	528.6	59.20	1662.8	1.567	852.3	0.803
3	0.955	9.968	15.391	527.9	58.43	1641.5	1.550	860.3	0.812
4	0.952	9.774	15.379	527.0	56.71	1596.4	1.513	876.9	0.831
5	0.948	9.673	15.397	526.7	54.97	1544.2	1.466	887.1	0.842
6	0.943	9.706	15.451	527.0	53.26	1481.9	1.407	887.3	0.842
7	0.935	9.867	15.565	527.9	51.40	1408.4	1.334	879.9	0.833
8	0.925	10.135	15.584	527.9	49.76	1323.2	1.249	856.4	0.808
9	0.913	10.480	15.545	527.3	48.01	1225.4	1.151	821.5	0.772
10	0.897	10.899	15.440	526.2	45.98	1111.0	1.038	773.8	0.723
11	0.878	11.462	15.365	525.4	42.64	964.7	0.895	712.0	0.660
12	0.853	11.748	15.328	525.1	39.43	875.8	0.809	679.4	0.628
13	0.816	11.904	15.250	524.4	33.27	780.4	0.720	656.1	0.605

STA 11.500 MASS AVERAGED PROPERTIES

PT= 15.448 TT= 527.04 GAMMA=1.4018 PT-RAT= 1.051 TT-RAT= 1.016

RCU= 283.5 VM= 829.0 CZ= 811.8 MM=0.781 MABS=0.782 MREL=1.276

ROTOR1 STA= 12.000 IN ROTOR

I= 9 MTIP=105 AFLOW= 170.55 D*C=0. D*H=0.

WTF= 61.365 OPTX=TT OPTY=PT ITYPE=5 INBR=3 ABC=0. ABH=0.

PSIC	Z	R	PHI	CURV	VM	CU	ALPHAM	MM
0.	-7.759	8.500	0.	0.	815 5	94.9	6.64	0.754
0.050	-7.778	8 323	-0.16	0.0356	822.9	93.4	6.47	0.762
0.100	-7.798	8.144	0.11	0.0412	832.6	91.7	6.29	0.773
0.200	-7.844	7.775	1.30	0.0261	855.5	92.0	6.14	0.798
0.300	-7.889	7.389	3.03	0.0030	870.9	93.4	6 12	0.815
0.400	-7.931	6.981	5.05	-0.0115	883.0	101.8	6.57	0.827
0.500	-7.972	6.544	7.31	-0.0130	888.5	114 1	7.32	0.832
0.600	-8.010	6.067	9.83	-0.0042	880.6	124.6	8.05	0.824
0.700	-8.024	5.534	12.79	0.0138	859.5	130.7	8.65	0.802
0.800	-7.995	4.919	16.68	0.0146	825.5	132.6	9.13	0 769
0.900	-7.946	4.148	21.90	0.0165	771.1	136.8	10.06	0.714
0.950	-7.936	3.645	25.22	0 0071	734.5	141 9	10 93	0.678
1.000	-7.941	2.971	28.21	0.0136	689.8	149 3	12.22	0.635

SL	BLDBLK	PS	PT	TT	BETAM	VREL	MREL	VABS	MABS
1	0.933	11.161	16.356	542.4	59.87	1624.6	1.502	821.0	0.759
2	0.932	11.093	16.382	541.6	59.11	1602.8	1.485	828.1	0.767
3	0.931	10.987	16.392	540.7	58.25	1582.2	1 469	837.6	0.778
4	0.927	10.767	16.459	539.8	56 24	1539.6	1.436	860.4	0 802
5	0.921	10.616	16.507	539.0	54.27	1491.3	1.395	875.9	0.819
6	0.912	10.569	16.658	539.6	52.00	1434.3	1.343	888 9	0.833
7	0.898	10.612	16.837	540.7	49.51	1368.4	1.282	895.8	0.839
8	0.882	10.740	16.916	540.9	47.05	1292.5	1.209	889.4	0.832
9	0.863	10.924	16.854	540.0	44.54	1206.0	1.126	869.4	0.812
10	0.840	11.155	16.654	537.9	41.69	1105.6	1.029	836.1	0.778
11	0.813	11.540	16.388	535.4	37.66	974.1	0.902	783.1	0.726
12	0.781	11.785	13.222	533.9	34.32	889.3	0.821	748.1	0.691
13	0.735	12.029	15.981	531.8	28.53	785.1	0.723	705.7	0.650

STA 12.000 MASS AVERAGED PROPERTIES

PT= 16.585 TT= 539.12 GAMMA=1.4018 PT-RAT= 1.129 TT-RAT= 1.039

RCU= 694.0 VM= 842.1 CZ= 824.3 MM=0 785 MABS=0.792 MREL=1.231

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ROTOR1                           STA= 12 500                        IN ROTOR
                  I=10           MTIP=118     AFLOW=   162.22      D*C=0.       D*H=0.
WTF=   61.365    OPTX=TT          OPTY=PT       ITYPE=5   INBR=3   ABC=0.       ABH=0.
   PSIC          Z         R        PHI         CURV         VM          CU      ALPHAM    MM
  0.          -7 556    8.500      0.         0.           772.8       150 5     11 02    0.701
  0 050       -7 565    8.322     -0.33      -0.0071       786.2       158 1     11.37    0.714
  0.100       -7 576    8.143     -0.20       0.0072       796.0       162.6     11.54    0.724
  0.200       -7.605    7.780      0.95       0.0255       816.8       168.2     11.64    0.745
  0.300       -7.635    7.402      2 80       0 0279       832.7       170 6     11.58    0.763
  0.400       -7.664    7.005      4 93       0.0278       849.9       178 2     11.84    0.781
  0.500       -7.692    6.580      7.18       0.0292       866.3       190.3     12.39    0.798
  0.600       -7.719    6.117      9.63       0.0284       873.0       201 6     13.00    0.806
  0 700       -7.724    5.602     12.52       0.0166       864.3       212.4     13 81    0 798
  0.800       -7.690    5 009     16.31       0.0252       844.4       226.0     14.99    0.779
  0.900       -7.645    4.268     21.60       0 0155       804.2       241 6     16.72    0.740
  0.950       -7.641    3.784     25.11       0.0046       767.0       242.9     17.57    0.705
  1.000       -7.658    3.123     28.51      -0.0461       708.3       236.3     18.45    0.650

   SL   BLDBLK     PS        PT       TT       BETAM     VREL       MREL      VABS     MABS
    1   0.911    12.361    17.377   556.4      60.20    1555.1     1.411     787.3    0 715
    2   0.911    12.372    17.616   557 4      59.04    1528.2     1.388     801.9    0.728
    3   0.909    12.367    17.780   557.7      58.01    1502.7     1.367     812.5    0.739
    4   0.905    12.274    18.020   557.2      55.86    1455.5     1.328     834 0    0.761
    5   0 898    12.135    18.118   555 9      53.75    1408.2     1.290     850.0    0 778
    6   0.887    11.998    18.256   555.4      51.22    1357.1     1.247     868.4    0.798
    7   0 869    11.865    18.404   555.6      48.26    1301.2     1.198     886.9    0.817
    8   0.850    11.764    18.432   555.0      45.16    1238.2     1.143     896.0    0.827
    9   0.828    11.778    18.357   553.7      41.92    1161.6     1.072     890.0    0.822
   10   0.803    11.862    18.207   552.0      37.92    1070.4     0.988     874 1    0.806
   11   0 765    12 029    17.869   549.0      32.46     953.1     0.878     839.7    0 773
   12   0.736    12.150    17.482   545.7      28.98     876.8     0.806     804.5    0.740
   13   0.683    12.325    16.876   540.4      23.96     775.1     0.711     746.7    0.685

                  STA   12.500   MASS AVERAGED PROPERTIES
   PT= 18.062   TT= 554.06   GAMMA=1.4017   PT-RAT= 1.229   TT-RAT=   1.068
   RCU=   1201.5   VM= 829.4   CZ= 811.6   MM=0.761   MABS=0.783   MREL=1.158
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ROTOR1 STA= 13.000 IN ROTOR

I=11 MTIP=131 AFLOW= 155.41 D*C=0. D*H=0.

WTF= 61.365 OPTX=TT OPTY=PT ITYPE=5 INBR=3 ABC=0. ABH=0.

PSIC	Z	R	PHI	CURV	VM	CU	ALPHAM	MM
0.	-7.352	8.500	0.	0.	739.5	206.0	15.57	0.661
0.050	-7.352	8.321	-0.51	0.0362	758.4	214.9	15.82	0.678
0.100	-7.354	8.142	-0.52	0.0439	776.2	221.2	15.90	0.696
0.200	-7.366	7.783	0.51	0.0379	807.8	229.6	15.87	0.728
0.300	-7.381	7.414	2.34	0.0346	827.9	232.6	15.70	0.749
0.400	-7 396	7.027	4.45	0.0339	847.2	239.8	15.81	0.770
0.500	-7.412	6.614	6.73	0.0266	866.3	254.0	16.34	0.790
0.600	-7.428	6.166	9.19	0.0238	876.2	269.5	17.10	0.801
0 700	-7.424	5.667	12.13	0.0273	876.7	285.4	18.03	0.803
0.800	-7.386	5.097	15.93	0.0172	864.2	302.3	19.28	0.793
0.900	-7.344	4.386	21.44	0.0016	837.5	320.1	20.92	0.769
0.950	-7.346	3.922	25.25	-0.0194	806.1	321.7	21.76	0.740
1.000	-7.375	3.281	29.92	-0.1052	732.5	318.7	23.51	0.670

SL	ELDBLK	PS	PT	TT	BETAM	VREL	MREL	VABS	MABS
1	0.893	13.454	18.431	570.2	60.25	1490.4	1.331	767.7	0.686
2	0.893	13.446	18.742	571.3	58.82	1465.0	1.310	788.3	0.705
3	0.892	13.392	18.981	571.7	57.44	1442.4	1.293	807.1	0.723
4	0.887	13.236	19.345	571.3	54.77	1400.3	1.261	839.8	0.756
5	0.879	13.059	19.489	569.4	52.42	1357.4	1.228	859.9	0.778
6	0.866	12.874	19.630	568.3	49.73	1310.8	1.191	880.5	0 800
7	0.847	12.690	19.804	568.1	46.51	1258.8	1.148	902.8	0.823
8	0 826	12 541	19.873	567.6	43.05	1199.0	1.096	916.7	0.838
9	0.803	12.421	19.817	566.3	39.19	1131.1	1.036	922.0	0.844
10	0.778	12.351	19.608	564.0	34.64	1050.5	0.963	915.6	0.840
11	0.740	12.251	19.126	560.0	28.46	952.7	0.875	896.6	0.823
12	0.705	12.240	18.609	555.8	24.68	887.1	0.815	867.9	0.797
13	0.656	12.504	17.848	549.5	19.56	777.4	0.711	798.8	0.731

STA 13.000 MASS AVERAGED PROPERTIES

PT= 19.385 TT= 566.74 GAMMA=1.4016 PT-RAT= 1.319 TT-RAT= 1.093

RCU= 1632.4 VM= 832.7 CZ= 814.7 MM=0.757 MABS=0.794 MREL=1.112

ROTOR1 STA= 13.500 IN ROTOR

I=12 MTIP=144 AFLOW= 151.01 D*C=0. D*H=0.

WTF= 61.365 OPTX=TT OPTY=PT ITYPE=5 INBR=3 ABC=0. ABH=0.

PSIC	Z	R	PHI	CURV	VM	CU	ALPHAM	MM
0.	-7.148	8.500	0.	0.	699.2	250.1	19.68	0.616
0.050	-7.138	8.318	-0.64	-0.0152	723.6	266.2	20.19	0.638
0.100	-7.132	8.139	-0.74	-0.0099	745.3	281.3	20.67	0.658
0.200	-7.128	7.784	0.10	0.0221	780.3	298.8	20.96	0.692
0.300	-7.128	7.423	1.83	0.0369	801.4	302.4	20.68	0.714
0.400	-7.129	7.047	3.94	0.0332	820.9	308.1	20.57	0.735
0.500	-7.132	6.646	6.23	0 0358	842.0	321.6	20.90	0.757
0.600	-7.137	6.212	8.73	0.0302	856.4	335.3	21.38	0.774
0.700	-7.124	5.731	11.74	0.0175	865.1	355.5	22.34	0.784
0.800	-7.081	5.183	15.81	-0.0043	858.8	379.9	23.86	0.781
0.900	-7.043	4.505	21.58	-0.0167	833.7	406.0	25.97	0.760
0.950	-7.051	4.062	25.78	-0.0379	813.3	409.8	26.74	0.743
1.000	-7.092	3.450	31.86	-0.0937	763.0	402 5	27.81	0.697

SL	BLDBLK	PS	PT	TT	BETAM	VREL	MREL	VABS	MABS
1	0.885	14.467	19.294	581.2	60.78	1432.2	1.262	742.6	0.654
2	0.885	14.518	19.792	583.8	58.95	1402.8	1.237	771.0	0.680
3	0.884	14.557	20.260	586.0	57.17	1374.7	1.214	796.6	0.703
4	0.880	14.522	20.913	587.1	54.02	1328.2	1.177	835.6	0.741
5	0.871	14.354	21.116	584.7	51.50	1287.4	1.147	856.6	0.763
6	0.857	14.133	21.236	582.6	48.73	1244.5	1.114	876.8	0.785
7	0.837	13.873	21.382	581.6	45.31	1197.4	1.077	901.4	0.811
8	0.815	13.580	21.361	580.0	41.62	1145.6	1.035	919.7	0.831
9	0.793	13.320	21.326	578.6	37.16	1085.6	0.984	935.3	0.848
10	0.768	13.137	21.157	576.6	31.91	1011.7	0.920	939.1	0.854
11	0.737	12.929	20.634	572.5	25.01	920.0	0.838	927.3	0.845
12	0.699	12.703	20.000	567.7	20.68	869.4	0.794	910.7	0.832
13	0.650	12.586	18.978	559.6	15.13	790.5	0.723	862.7	0.789

STA 13.500 MASS AVERAGED PROPERTIES

PT= 20.856 TT= 580.12 GAMMA=1.4015 PT-RAT= 1.419 TT-RAT= 1.118

RCU= 2087.5 VM= 814.3 CZ= 796.2 MM=0.732 MABS=0.791 MREL=1.051

ROTOR1 STA= 14.000 IN ROTOR

I=13 MTIP=157 AFLOW= 147 59 D*C=0 D*H=0.

WTF= 61.365 OPTX=TT OPTY=PT ITYPE=5 INBR=3 ABC=0. ABH=0.

PSIC	Z	R	PHI	CURV	VM	CU	ALPHAM	MM
0.	-6.945	8.500	0.	0.	668.1	294.3	23.77	0.582
0 050	-6.925	8.316	-0.44	-0.0172	697.4	313.9	24.23	0.608
0.100	-6.910	8.137	-0.54	-0.0213	721.9	331.3	24.65	0.630
0.200	-6.889	7.784	0.06	-0.0160	762.8	358.5	25.17	0.668
0.300	-6.874	7.430	1.49	0.0086	783.9	368.5	25.18	0.690
0.400	-6.862	7.064	3.44	0.0312	802.2	374.8	25.04	0.710
0.500	-6.853	6.675	5.69	0 0309	819.8	384.3	25.11	0.729
0.600	-6.846	6.255	8.29	0.0218	834.5	399.7	25.59	0.745
0.700	-6.824	5.792	11.52	0.0076	844.0	422.2	26.57	0.757
0.800	-6.777	5.269	15.87	-0 0017	850.1	455.7	28.19	0.766
0.900	-6.742	4.625	22.01	-0.0293	832.9	484.6	30.19	0.754
0.950	-6.756	4.207	26.51	-0.0396	813.6	492.1	31.17	0.739
1.000	-6.809	3.632	33.48	-0.0749	784.6	490.0	31.99	0.716

SL	BLDBLK	PS	PT	TT	BETAM	VREL	MREL	VABS	MABS
1	0.878	15.368	20.180	592.3	61.01	1378.5	1.201	730.0	0.636
2	0.879	15.433	20.801	595.5	58.85	1348.1	1.176	764.8	0.667
3	0.878	15.488	21.364	598.0	56.83	1319.6	1 152	794.3.	0.694
4	0.874	15.536	22.326	600.8	53.08	1269.8	1.113	842.9	0.739
5	0.867	15.470	22.736	599.2	50.26	1226.0	1.079	866.1	0.762
6	0.853	15.266	22.896	596.6	47.38	1184.7	1.048	885.4	0.783
7	0.834	14.966	22.935	594.2	44.07	1141.1	1.015	905.4	0.805
8	0.814	14.629	22.911	592.2	40.16	1091.9	0.975	925.2	0.827
9	0.793	14.303	22.869	590.6	35.41	1035.5	0.929	943.7	0.847
10	0.770	13.928	22.803	589.3	29.15	973.4	0.877	964.5	0.869
11	0.739	13.499	22.174	584.6	21.71	896.5	0.812	963.6	0.872
12	0.711	13.196	21.469	579.6	17.11	851.2	0.773	950.8	0.863
13	0.662	12.751	20.324	571.1	10.89	799.0	0.729	925.0	0.844

STA 14.000 MASS AVERAGED PROPERTIES

PT= 22.329 TT= 592.83 GAMMA=1.4014 PT-RAT= 1.519 TT-RAT= 1.143

RCU= 2520.0 VM= 798.2 CZ= 779.7 MM=0.710 MABS=0.794 MREL=0.997

ROTOR1 STA= 14.500 IN ROTOR

I=14 MTIP=170 AFLOW= 145.49 D*C=0. D*H=0.

WTF= 61.365 OPTX=TT OPTY=PT ITYPE=5 INBR=3 ABC=0. ABH=0.

PSIC	Z	R	PHI	CURV	VM	CU	ALPHAM	MM
0.	-6.741	8.500	0.	0.	632 9	363.1	29.85	0.543
0.050	-6.712	8.315	-0.29	-0.0072	662.8	381.3	29.91	0.570
0.100	-6.688	8.135	-0.27	-0.0216	688.4	397.7	30.01	0.593
0.200	-6.650	7.785	0.30	-0.0182	733.1	424 0	30 05	0.634
0.300	-6.620	7.436	1.43	0 0004	757.6	433.8	29.79	0.659
0.400	-6.595	7.079	3.14	0.0082	776.3	440.6	29.58	0.679
0.500	-6.573	6.702	5.37	0.0086	790.8	451.0	29.69	0.695
0.600	-6.555	6.297	8.08	0.0040	802.8	467.8	30.23	0./09
0 700	-6.524	5.853	11.48	-0 0032	812.9	492.3	31.20	0.721
0.800	-6.472	5.356	16 04	-0.0173	822.4	528.2	32.71	0.734
0.900	-6.441	4.748	22.64	-0.0385	824.4	564.2	34.39	0.741
0.950	-6.461	4.357	27.55	-0.0695	814.9	577 3	35.32	0.736
1.000	-6.526	3.824	34.87	-0.0668	796.8	588.7	36.46	0.724

SL	BLDBLK	PS	PT	TT	BETAM	VREL	MREL	VABS	MABS
1	0.877	16.593	21.609	609.5	60.90	1301.2	1.116	729.6	0 626
2	0.879	16.669	22.277	611.9	58.60	1272.3	1.093	764.7	0.657
3	0.879	16.724	22.884	613.8	56.45	1245.5	1.072	795.0	0.684
4	0.876	16.760	23.948	615.8	52.34	1199.7	1.038	846.9	0.732
5	0.869	16.668	24.420	613.6	49.23	1160.1	1.009	873.0	0.759
6	0.857	16.466	24.625	610.4	46.17	1120.9	0.980	892.6	0.780
7	0.840	16.187	24.678	607.6	42.78	1077.4	0.947	910.4	0.800
8	0.823	15.841	24.652	605.3	38.71	1028.8	0.908	929.2	0.820
9	0.805	15.445	24.601	603.4	33.63	976.2	0.866	950.3	0.843
10	0.787	14.935	24.521	601.9	26.89	922.0	0.823	977.4	0.872
11	0.756	14.153	23.897	597.5	18.37	868 6	0.781	999.0	0.898
12	0.734	13.664	23.170	592.7	13.23	837.1	0.756	998.7	0.902
13	0.699	13.016	22.035	584.9	6.17	801.4	0.728	990.7	0.900

STA 14.500 MASS AVERAGED PROPERTIES

PT= 24.006 TT= 606.74 GAMMA=1.4012 PT-RAT= 1.633 TT-RAT= 1.170

RCU= 2993.7 VM= 772.7 CZ= 753.6 MM=0.680 MABS=0.796 MREL=0.935

ROTOR1 STA= 15.000 IN ROTOR

I=15 MTIP=183 AFLOW= 144 66 D*C=0. D*H=0.

WTF= 61.365 OPTX=TT OPTY=PT ITYPE=5 INBR=3 ABC=0. ABH=0.

PSIC	Z	R	PHI	CURV	VM	CU	ALPHAM	MM
0.	-6.538	8 500	0.	0.	591.4	462 9	38.05	0.498
0.050	-6.499	8.314	-0.24	-0.0008	623.6	474 5	37.27	0.526
0.100	-6.466	8 135	-0.20	0 0105	651.1	483.4	36.59	0.552
0.200	-6.411	7 786	0.36	0.0094	698.2	493.1	35.23	0.596
0.300	-6.367	7.443	1.47	-0.0059	727.7	497.9	34.38	0.626
0.400	-6.327	7.093	3.18	-0.0131	747.9	505 1	34.04	0.647
0.500	-6.293	6 728	5.43	-0.0155	760.5	516.0	34.16	0.661
0.600	-6.264	6.338	8 20	-0.0184	769.9	533.9	34.74	0.672
0.700	-6.224	5 914	11.73	-0.0252	778.0	559.6	35.73	0.683
0.800	-6.168	5.445	16.47	-0.0297	789.1	596.9	37.10	0.697
0.900	-6.140	4 876	23.49	-0.0524	799.4	643.9	38.85	0 713
0.950	-6.166	4.515	28.62	-0.0427	806.9	670.8	39.74	0.724
1.000	-6.243	4.026	36.12	-0.0570	815.4	710.2	41.06	0.740

SL	BLDBLK	PS	PT	TT	BETAM	VREL	MREL	VABS	MABS
1	0.883	18.167	23.777	634.3	60.31	1193.9	1.005	751.0	0.632
2	0.885	18.200	24.416	634.6	57.87	1172.3	0.990	783.5	0.662
3	0.886	18.188	24.943	634.3	55.64	1153.5	0.977	810.9	0.687
4	0.883	18.058	25.738	631.6	51.60	1124.1	0.960	854.8	0.730
5	0.878	17.871	26.154	627.6	48 26	1093.0	0.940	881.7	0.758
6	0.868	17.658	26.407	624.0	44.95	1056.8	0.914	902.5	0.780
7	0.855	17.386	26.477	620.8	41.44	1014.4	0.882	919.0	0.799
8	0.842	17.031	26.448	618.2	37.21	966.7	0.844	936.9	0.818
9	0.829	16.599	26.390	616.0	31.89	916.3	0.804	958.3	0.841
10	0.817	15.980	26.295	614.3	24.76	869.0	0.768	989.4	0.874
11	0.795	15.007	25.810	611.0	15.16	828.3	0.738	1026.5	0.915
12	0.778	14.247	25.244	607.8	8.87	816.7	0.733	1049.4	0.942
13	0.746	13.168	24.388	602.8	0.01	815.4	0.740	1081.4	0.981

STA 15.000 MASS AVERAGED PROPERTIES

PT= 25.878 TT= 621.69 GAMMA=1.4010 PT-RAT= 1.761 TT-RAT= 1.199

RCU= 3503.1 VM= 742.6 CZ= 722.7 MM=0.646 MABS=0 801 MREL=0.870

ROTOR1 STA= 15.500 IN ROTOR

	I=16		MTIP=196	AFLOW=	145.33	D*C=0.		D*H=0.
WTF= 61.365	OPTX=TT		OPTY=PT	ITYPE=5	INBR=3	ABC=0.		ABH=0.
PSIC	Z	R	PHI	CURV	VM	CU	ALPHAM	MM
0.	-6.334	8.500	0.	0.	555.4	541.4	44.27	0.461
0.050	-6.286	8.313	-0.42	0.0300	590.8	543.3	42.60	0.493
0.100	-6.243	8.133	-0.37	0.0175	620.0	544.0	41.26	0.520
0.200	-6.172	7.788	0.38	-0.0120	668.8	547.4	39.30	0.565
0.300	-6.113	7.450	1.73	-0.0304	698 3	552.3	38.34	0.595
0.400	-6.060	7.109	3.58	-0.0390	716.9	559.6	37.98	0.614
0.500	-6.013	6.756	5.90	-0.0432	726.3	570.6	38.16	0.625
0.600	-5.973	6.381	8.74	-0.0461	731.7	588.7	38.82	0.633
0.700	-5.925	5.978	12.33	-0.0437	738.3	614.7	39.78	0.642
0.800	-5.864	5.536	17.11	-0.0415	750.3	651.7	40.98	0.657
0.900	-5.838	5.010	24.18	-0.0203	777.8	704.3	42.16	0.688
0.950	-5.871	4.679	29.48	-0.0461	797.1	740.3	42 88	0.711
1.000	-5.960	4.235	36.53	0.0158	837.9	799.8	43.67	0.759

SL	BLDBLK	PS	PT	TT	BETAM	VREL	MREL	VABS	MABS
1	0.900	19.348	25.568	653.9	59.91	1107.8	0.920	775.6	0.644
2	0.902	19.302	26.071	651.4	57.40	1096.5	0.915	802.6	0.670
3	0.902	19.224	26.464	648.7	55.18	1085.7	0.910	824.8	0.691
4	0.900	19.070	27.205	644.0	51.03	1063.4	0.899	864.3	0.731
5	0.897	18.920	27.694	639.6	47.51	1033.8	0.880	890.3	0.758
6	0.891	18.743	27.994	635.6	44.11	99[illegible]	0.855	909.4	0.779
7	0.883	18.504	28.080	632.0	40.56	95[illegible] 9	0.823	923.6	0.795
8	0.876	18.170	2[illegible].050	629.1	36.29	907.3	0.785	939.1	0.812
9	0.870	17.709	27.985	626.7	30.81	859.6	0.747	960.7	0.835
10	0.864	17.014	27.876	624.8	23.44	817.8	0 716	993.8	0.870
11	0.849	15.752	27.505	622.4	13.02	798 3	0.707	1049.3	0.929
12	0.833	14.800	27.101	620.5	6.12	801.7	0.715	1087.8	0.971
13	0.807	13.228	26.566	618.3	-3.58	839.6	0.761	1158.4	1.049

STA 15.500 MASS AVERAGED PROPERTIES

PT= 27.493 TT= 633.92 GAMMA=1.4008 PT-RAT= 1.871 TT-RAT= 1.222

RCU= 3920.2 VM= 712.1 CZ= 691.3 MM=0.614 MABS=0.804 MREL=0.815

ROTOR1 STA= 16.000 TE ROTOR

I=17 MTIP=209 AFLOW= 148.37 D*C=0. D*H=0.

WTF= 61.365 OPTX=TT OPTY=PT ITYPE=6 INBR=3 ABC=0. ABH=0.

PSIC	Z	R	PHI	CURV	VM	CU	ALPHAM	MM
0	-6.131	8.500	0.	0.	517.5	583.6	48.43	0.426
0.050	-6.073	8.311	-0.32	-0.0452	561.1	585.7	46.23	0.465
0.100	-6.021	8.132	-0.07	-0.0653	591.7	586.5	44.75	0.492
0.200	-5.933	7.790	1.05	-0.0864	639.5	589.9	42.69	0.537
0.300	-5.859	7.459	2.62	-0.0914	665.7	594.5	41.77	0.562
0.400	-5.792	7.127	4.52	-0.0832	680.4	601.6	41.48	0.578
0.500	-5.733	6 787	6.79	-0.0673	685.4	612.2	41.77	0.585
0 600	-5.682	6.428	9.52	-0.0464	686.7	629.9	42.53	0.589
0.700	-5.625	6.045	12.89	-0.0193	691.6	655.1	43.45	0.596
0.800	-5.559	5.631	17.24	0.0282	704.9	690.5	44.41	0.612
0.900	-5.537	5.146	23.63	0.0784	725.0	746.5	45.84	0.635
0.950	-5.576	4.846	28.25	0.1725	754.4	791.9	46.39	0 667
1.000	-5.677	4.442	35.49	0.0883	779.2	870.1	48.16	0.698

SL	BLDBLK	PS	PT	TT	BETAM	VREL	MREL	VABS	MABS
1	0.926	20.126	26.560	664.4	60.55	1052.4	0.867	780.0	0.642
2	0.927	20.046	27.120	661.7	57.51	1044.4	0.865	811.1	0.672
3	0.927	19.990	27.560	658.8	55.11	1034.5	0.861	833.1.	0.693
4	0.927	19.913	28.390	653.7	50.82	1012.4	0.850	870.0	0.730
5	0.928	19.848	28.940	649.0	47.31	981.8	0.830	892.6	0.754
6	0.928	19.745	29.280	644.7	43.96	945.2	0.803	908.2	0.772
7	0.928	19.563	29.380	640.8	40.50	901.4	0.770	919.0	0.785
8	0.928	19.266	29.350	637.7	36.30	852.0	0.731	931.9	0.799
9	0.928	18.799	29.280	635.1	30.77	804.8	0.694	952.6	0.821
10	0.928	18.054	29.160	633.0	23.28	767.4	0.666	986.7	0.856
11	0.930	16.873	28.920	631.6	12.56	742.8	0.651	1040.6	0.912
12	0.914	15.782	28.770	631.5	4.80	757.1	0.669	1093.7	0.967
13	0.875	14.331	28.650	632.3	-6.32	783.9	0.702	1168.0	1.046

STA 16.000 MASS AVERAGED PROPERTIES

PT= 28.783 TT= 643.26 GAMMA=1.4006 PT-RAT= 1.959 TT-RAT= 1.240

RCU= 4238.7 VM= 672.4 CZ= 653.1 MM=0.575 MABS=0.796 MREL=0.764

	AVERAGE	BLADE SPEED		ACC PT	ACC TT	EFFICIENCY		AXIAL
PCT IMM	RAD	IN	OUT	RATIO	RATIO	AD.	POLY	VEL R
0.	8.500	1500.0	1500.0	1.8073	1.2809	0.656	0.683	0.621
3.7	8.316	1468.6	1466.7	1.8454	1.2757	0.694	0.719	0.672
7.4	8.136	1436.4	1435.1	1.8753	1.2701	0.729	0.752	0.708
14.6	7.776	1369.7	1374.7	1.9318	1.2603	0.796	0.814	0.765
22.0	7.410	1299.2	1316.2	1.9692	1.2512	0.851	0.864	0.802
29.7	7.031	1223.9	1257.8	1.9924	1.2429	0.897	0.906	0.831
37.7	6.631	1142.6	1197.6	1.9992	1.2354	0.930	0.937	0.859
4€.5	6.198	1053.1	1134.3	1.9971	1.2294	0.953	0.957	0.896
56.1	5.721	952.4	1066.8	1.9924	1.2244	0.971	0.973	0.957
67.0	5.183	835.6	993.8	1.9842	1.2204	0.982	0.984	1.049
80.3	4.525	688.9	908.0	1 9679	1.2177	0.981	0 983	1.186
88.8	4.103	593.0	855.2	1.9577	1.2175	0.974	0.976	1.321
100.0	3 547	468.2	783.8	1.9495	1.2190	0.960	0.964	1.338

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FREE                         STA= 17.000                               FREE
               I=18          MTIP=222     AFLOW=  146.27     D*C=0.       D*H=0.
WTF=  61.365   OPTX=DPP     OPTY=FREE   ITYPE=0  INBR=0  ABC=0.       ABH=0.
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PSIC	Z	R	PHI	CURV	VM	CU	ALPHAM	MM
0.	-5.700	8.500	0.	0.	509.5	583 6	48 88	0.419
0.050	-5.639	8.313	0.81	-0.0461	560.1	585.6	46.27	0.464
0.100	-5.586	8.138	1.56	-0.0653	594.9	586.1	44.57	0.495
0.200	-5.498	7.806	3.02	-0.0720	650.1	588.7	42.16	0.546
0.300	-5.429	7.486	4.50	-0.0611	681.6	592.4	40.99	0.577
0.400	-5.374	7.167	6.07	-0.0455	701.4	598.3	40.46	0.597
0.500	-5.332	6.839	7.86	-0.0248	710.5	607.5	40.53	0.608
0.600	-5.305	6.494	10.03	0.0002	714.3	623 5	41.12	0.614
0.700	-5.294	6.122	12.78	0.0300	718.4	646.9	42.00	0.621
0.800	-5.304	5.709	16.53	0.0643	721 5	681.1	43.35	0.627
0.900	-5 350	5.225	22.35	0.1421	728.6	735.1	45.25	0.638
0.950	-5.405	4.934	26.15	0.2095	742.8	777.7	46.32	0.655
1.000	-5.521	4.550	33.90	0.2101	729.7	849 4	49.34	0.648

SL	BLDBLK	PS	PT	TT	BETAM	VREL	MREL	VABS	MABS
1	0.940	20.185	26.533	664.4	60.93	1048 5	0 863	774.7	0.638
2	0.940	20.037	27.093	661.7	57.[illegible]	1044.3	0.865	810.4	0.671
3	0.940	19.937	27.532	658.8	55.01	1037.5	0.863	835.1	0.695
4	0.940	19.794	28.390	653.7	50.51	1022.2	0.859	877.0	0.737
5	0.940	19.661	28.940	649.0	46.91	997.8	0.844	903.1	0.764
6	0.940	19.496	29.280	644 7	43.54	967.6	0.824	921.9	0.785
7	0.940	19.273	29.380	640.8	40.15	929.6	0.795	934.8	0.800
8	0.940	18.964	29.350	637 7	36.18	884.9	0.761	948.1	0.815
9	0.940	18.534	29.280	635 1	31.10	839.0	0.725	966.8	0.835
10	0.940	17.952	29.160	633.0	24.35	791.9	0.688	992.2	0.862
11	0 940	16.979	28.920	631.6	14.40	752.2	0.659	1035.0	0.906
12	0.940	16.127	28.770	631.5	7.14	748.6	0.660	1075.4	0.948
13	0.940	15.192	28.564	632.3	-3.65	731.1	0.649	1119.8	0.994

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                STA   17.000   MASS AVERAGED PROPERTIES
PT= 28.777  TT= 643.26  GAMMA=1.4006  PT-RAT= 1.958  TT-RAT=  1.240
RCU=  4238.7  VM= 685.2  CZ= 666 9  MM=0.586  MABS=0.802  MREL=0.778
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STATOR STA= 18.000 LE STATOR

I=19 MTIP=235 AFLOW= 141.60 D*C=0. D*H=0.

WTF= 61.365 OPTX=DPP OPTY=FREE ITYPE=1 INBR=4 ABC=0. ABH=0.

PSIC	Z	R	PHI	CURV	VM	CU	ALPHAM	MM
0	-5.250	8.500	0.	0.	552.0	583.6	46.60	0.456
0 050	-5.192	8.323	1.46	-0.0051	591.7	584.9	44.67	0.491
0.100	-5.143	8.155	2.54	-0.0117	621.7	584.8	43.25	0.518
0 200	-5.063	7.835	4.18	-0.0203	674.0	586 5	41.03	0.567
0.300	-5.003	7.525	5.53	-0.0230	706.9	589.3	39.82	0.599
0.400	-4.962	7.215	6.88	-0.0233	729.3	594.3	39.18	0.622
0 500	-4.938	6.896	6.38	-0.0212	741.8	602.5	39.08	0.637
0.600	-4.933	6.560	10.22	-0.0175	749.4	617.2	39.48	0.646
0.700	-4.953	6.198	12.60	-0.0118	757.0	639.0	40.17	0.656
0.800	-5.004	5.796	15.90	0.0056	764.0	670.9	41.29	0.666
0.900	-5.108	5.321	21.07	0.0285	767.9	721.9	43.23	0.674
0.950	-5.201	5.029	24.63	0.0260	755.5	763.0	45.28	0.666
1 000	-5.375	4.643	31.23	0.3271	798.9	832.3	46.17	0.713

SL	BLDBLK	PS	PT	TT	BETAM	VREL	MREL	VABS	MABS
1	0.940	19.756	26.533	664.4	58.94	1069.8	0.883	803.3	0.663
2	0.940	19.698	27.093	661.7	56.20	1063.6	0.883	832.0	0.691
3	0.940	19.639	27.532	656.8	53.96	1056.6	0.881	853.5	0.712
4	0.940	19.511	28.390	653.7	49.75	1043.1	0.878	893.5	0.752
5	0.940	19.353	28.940	649.0	46.26	1022 3	0.867	920.3	0.780
6	0.940	19.150	29.280	644.7	42.95	996.3	0.850	940.8	0.803
7	0.940	18.886	29.380	640.8	39.63	963.2	0.827	955.7	0.820
8	0.940	18.539	29.350	637.7	35.79	923.9	0.797	970.9	0.837
9	0.940	18.086	29.280	635.1	30.99	883.1	0.765	990.6	0.859
10	0.940	17.487	29.160	633.0	24.73	841.2	0.733	1016.8	0.887
11	0.940	16.620	28.920	631.6	15.78	798.0	0.701	1054.0	0.926
12	0.940	16.160	28.770	631.5	9.36	765.7	0.675	1073.7	0.946
13	0.940	14.557	28.564	632.3	-0 92	799.0	0.713	1153.6	1.030

STA 18.000 MASS AVERAGED PROPERTIES

PT= 28.777 TT= 643.26 GAMMA=1.4007 PT-RAT= 1.958 TT-RAT= 1.240

RCU= 4238.7 VM= 717 6 CZ= 699.6 MM=0 616 MABS=0 821 MREL=0 808

STATOR　STA= 19.000　IN STATOR

I=20　MTIP=248　AFLOW= 126.04　D*C=0.　D*H=0.

WTF= 61.365　OPTX=DPP　OPTY=BETM　ITYPE=2　INBR=4　ABC=0.　ABH=0.

PSIC	Z	R	PHI	CURV	VM	CU	ALPHAM	MM
0.	-4.770	8.500	0.	0.	615 2	375.8	31.42	0.504
0.050	-4.723	8.335	1.11	0.0316	644.1	384 8	30.86	0.530
0.100	-4.683	8.175	2.03	0 0506	667.5	391.3	30.38	0.552
0.200	-4.616	7.868	3.58	0.0670	712.4	406.2	29.69	0.594
0.300	-4.566	7.568	4.97	0 0675	744.1	417.3	29 29	0.626
0.400	-4.532	7.267	6.40	0.0622	767.6	427.8	29.13	0.650
0.500	-4.512	6.959	7.99	0.0529	783.0	437.9	29.22	0.667
0.600	-4.508	6.637	9.88	0.0445	796.1	450 4	29 50	0.681
0.700	-4.524	6.293	12.21	0.0431	812 2	469.8	30 05	0 699
0.800	-4.565	5.919	15.21	0.0474	833 2	499 3	30 93	0.722
0.900	-4.641	5.495	19.44	0.0857	863.5	540 7	32.05	0.754
0.950	-4.696	5.253	22.40	0.1150	888.3	568.3	32.61	0.780
1.000	-4.770	4.975	26.23	0.1265	919 4	606 2	33.40	0.813

SL	BLDBLK	PS	PT	TT	BETAM	VREL	MREL	VABS	MABS
1	0.875	20.965	26.533	664.4	61.31	1281.5	1.049	720.9	0.590
2	0.877	20.953	27.093	661.7	59.33	1262.7	1.039	750.3	0.617
3	0.878	20.908	27.532	658.8	57.59	1245.4	1.030	773.8	0.640
4	0.879	20.754	28.390	653.7	54 04	1213.4	1.012	820.1	0.684
5	0.880	20.539	28.940	649.0	50.98	1181.8	0.994	853.1	0.717
6	0.881	20.274	29.280	644.7	48 07	1148.7	0.972	878.8	0.744
7	0.880	19.963	29.380	640.8	45.26	1112.4	0.947	897.1	0.764
8	0.880	19.582	29.350	637.7	42.16	1073.9	0.919	914.7	0.783
9	0.878	19.066	29.280	635.1	38.27	1034.5	0.890	938.3	0.807
10	0.875	18.343	29.160	633.0	33 20	995.8	0.862	971.3	0 841
11	0.867	17.284	28.920	631.6	26.42	964.2	0.842	1018.8	0.890
12	0.857	16.521	28.770	631.5	21.99	958.0	0.841	1054.5	0.926
13	0.837	15.540	28.564	632.3	16.47	958.8	0.848	1101.3	0.974

STA 19.000 MASS AVERAGED PROPERTIES

PT= 28.777　TT= 643.26　GAMMA=1.4005　PT-RAT= 1.958　TT-RAT= 1.240

RCU= 3068.9　VM= 774.7　CZ= 757 3　MM=0.660　MABS=0.765　MREL=0.942

STATOR STA= 20.000 IN STATOR

I=21 MTIP=261 AFLOW= 118.86 D*C=0. D*H=0.

WTF= 61.365 OPTX=DPP OPTY=BETM ITYPE=2 INBR=4 ABC=0. ABH=0.

PSIC	Z	R	PHI	CURV	VM	CU	ALPHAM	MM
0.	-4.300	8.500	0.	0.	655.1	262.3	21.82	0.536
0.050	-4.277	8.341	0.65	0.0045	685.0	271.8	21.64	0.563
0.100	-4.257	8.187	1.30	0.0093	707.3	278 4	21.49	0.584
0.200	-4.225	7.888	2.63	0.0179	748.4	290.8	21.24	0.623
0.300	-4.200	7.596	4.01	0.0240	775.0	298.0	21.03	0.650
0.400	-4.184	7.303	5.49	0.0291	793.5	303.0	20.90	0.669
0.500	-4.174	7.004	7.13	0.0358	804.2	306.5	20.86	0.682
0.600	-4.173	6.693	9.01	0.0450	813 4	311.0	20 93	0.692
0.700	-4.180	6.365	11.21	0 0560	825.9	319.5	21.15	0.706
0.800	-4.199	6.015	13.89	0.0745	844.3	334.1	21.59	0.725
0.900	-4.233	5.631	17.33	0 0855	869.3	354.8	22.20	0.750
0.950	-4.261	5.420	19.55	0.0986	886.5	367.5	22.52	0.767
1.000	-4.300	5.188	22.50	0.1259	908.2	383.9	22.91	0.789

SL	BLDBLK	PS	PT	TT	BETAM	VREL	MREL	VABS	MABS
1	0.849	21.180	26.533	664.4	62.11	1400.3	1.145	705.7	0.577
2	0.851	21.151	27.093	661.7	60.28	1381.8	1.135	737.0	0.606
3	0.852	21.118	27.532	658.8	58.77	1364.0	1.126	760.1	0.628
4	0.855	21.037	28.390	653.7	55.80	1331.4	1.109	802.9	0.669
5	0.857	20.932	28.940	649.0	53.37	1298.9	1.089	830.3	0.696
6	0.859	20.796	29.280	644 7	51.17	1265.4	1.067	849.4	0.716
7	0.860	20.621	29.380	640.8	49.13	1229.1	1.042	860.6	0.729
8	0.860	20.380	29.350	637.7	46.93	1191.0	1.013	870.8	0.741
9	0.858	20.034	29.280	635.1	44.22	1152.4	0.985	885.5	0.757
10	0.855	19.515	29.160	633.0	40.74	1114.4	0.957	908.0	0.780
11	0.847	18.772	28.920	631.6	36.31	1078.8	0.931	938.9	0.810
12	0.840	18.292	28.770	631.5	33.59	1064.2	0.921	959.7	0.831
13	0.828	17.689	28.564	632.3	30.34	1052.4	0.914	986.0	0.856

STA 20.000 MASS AVERAGED PROPERTIES

PT= 28.777 TT= 643.26 GAMMA=1.4003 PT-RAT= 1.958 TT-RAT= 1.240

RCU= 2143.5 VM= 756.4 CZ= 782.8 MM=0.674 MABS=0.724 MREL=1.035

STATOR STA= 21.000 IN STATOR

I=22 MTIP=274 AFLOW= 115.14 D*C=0. D*H=0.

WTF= 61.365 OPTX=DPP OPTY=BETM ITYPE=2 INBR=4 ABC=0. ABH=0.

PSIC	Z	R	PHI	CURV	VM	CU	ALPHAM	MM
0.	-3.800	8.500	0.	0.	672.1	170.1	14 20	0 549
0.050	-3.800	8.346	0.54	0.0029	703.2	175.6	14.02	0.577
0.100	-3.800	8.196	1 11	0.0051	726.1	179.1	13.86	0.599
0.200	-3.800	7.906	2.29	0.0101	767.8	185.7	13.59	0.639
0 300	-3.800	7.622	3.54	0.0168	793.8	189.3	13.41	0.665
0.400	-3.800	7.3[illegible]	4.89	0.0247	811.5	191.7	13 29	0.683
0.500	-3.800	7.048	6.37	0.0341	821.1	192.7	13.21	0.694
0.600	-3.800	6.749	8.04	0.0449	828.7	193 7	13.16	0.703
0.700	-3.800	6.436	9.95	0 0572	838.4	196.7	13.20	0.714
0.800	-3 800	6.107	12.18	0.0715	850 9	203.4	13.44	0.727
0.900	-3.800	5.756	14.97	0.0980	867.3	212.9	13.79	0.744
0.950	-3.800	5.570	16.63	0.1116	879 9	217 7	13.90	0.756
1 000	-3.800	5.376	18.63	0.1266	894.5	222 6	13.98	0.770

SL	BLDBLK	PS	PT	TT	BETAM	VREL	MREL	VABS	MABS
1	0.849	21.352	26.533	664.4	63.19	1490.1	1.217	693.3	0.566
2	0.850	21.330	27.093	661.7	61 54	1475.5	1.211	724.8	0.595
3	0.851	21.305	27.532	658.8	60.19	1460.5	1.204	747.9	0.617
4	0.853	21.249	28.390	653.7	57.59	1432.6	1.191	790.0	0.657
5	0.855	21 174	28.940	649.0	55.51	1402.1	1.174	816.1	0.683
6	0.856	21.069	29.280	644.7	53.66	1369.5	1.153	833.8	0.702
7	0.858	20.926	29.380	640.8	52.00	1333.7	1.128	843.5	0.713
8	0.858	20.734	29.350	637.7	50 27	1296.6	1.101	851.0	0.722
9	0.859	20.472	29.280	635.1	48.24	1258.9	1.072	861.2	0.734
10	0.858	20.118	29.160	633.0	45.78	1220.0	1.043	874.8	0 748
11	0.855	19.608	28.920	631.6	42.79	1181 9	1.014	893.0	0.766
12	0.854	19.263	28.770	631.5	41.01	1166.1	1.002	906.5	0.779
13	0.852	18.860	28.564	632.3	39.06	1152.0	0.991	921.8	0.793

STA 21.000 MASS AVERAGED PROPERTIES

PT= 28.777 TT= 643.26 GAMMA=1.4003 PT-RAT= 1.958 TT-RAT= 1.240

RCU= 1351.1 VM= 809.1 CZ= 798.8 MM=0.683 MABS=0.702 MREL=1.118

STATOR STA= 22.000 IN STATOR

I=23 MTIP=287 AFLOW= 114.72 D*C=0. D*H=0.

WTF= 61.365 OPTX=DPP OPTY=BETM ITYPE=2 INBR=4 ABC=0. ABH=0.

PSIC	Z	R	PHI	CURV	VM	CU	ALPHAM	MM
0.	-3.204	8 500	0.	0.	663.5	83 7	7.19	0.541
0.050	-3.211	8.351	0.55	-0.0032	695.3	86.3	7.08	0.569
0.100	-3.218	8.207	1.05	-0.0017	718.2	87.8	6.97	0.591
0.200	-3.232	7.927	2.01	0.0066	760.3	90.6	6.79	0.631
0.300	-3.245	7.653	3.03	0.0155	786.5	91 8	6.66	0.657
0.400	-3.259	7.380	4.13	0.0243	804.4	92.5	6.56	0.675
0.500	-3.272	7.102	5.36	0.0329	813.9	92.5	6.48	0.686
0.600	-3.287	6.815	6.74	0.0428	820.8	92.5	6.43	0.695
0.700	-3.301	6.516	8.33	0.0546	829 6	93.4	6.43	0.704
0.800	-3.316	6.203	10.35	0.0577	839.6	95.7	6.51	0.715
0.900	-3.333	5.870	12.73	0.0642	847.5	98.8	6.65	0 723
0 950	-3.341	5.695	13.99	0.0824	853.1	100 5	6.72	0.729
1 000	-3.350	5.512	15.23	0.1249	862.9	102 5	6.77	0.737

SL	BLDBLK	PS	PT	TT	BETAM	VREL	MREL	VABS	MABS
1	0.880	21.688	26.533	664.4	64.90	1564.0	1.274	668.7	0.545
2	0.880	21.678	27.093	661.7	63 38	1551 9	1.271	700.6	0 574
3	0.881	21.670	27.532	658.8	62.17	1538.3	1.265	723.5	0.595
4	0.882	21.641	28.390	653.7	59.84	1513.1	1.255	765.6	0.635
5	0.883	21.581	28.940	649.0	58.00	1484.3	1.239	791.9	0.66(
6	0.883	21.487	29.280	644.7	56.38	1452.9	1.220	809.7	0.680
7	0.884	21.353	29.380	640.8	54.96	1417.7	1.196	819.1	0.691
8	0.885	21.176	29.350	637.7	53.52	1380.6	1.168	826.0	0.699
9	0.886	20.941	29.280	635.1	51.86	1343.3	1.140	834.8	0.709
10	0.8P5	20.650	29.160	633.0	49.95	1304.9	1.111	845.0	0.720
11	0.886	20.319	28.920	631.6	47.88	1263.5	1.078	853.2	0.728
12	0.887	20.111	28.770	631.5	46.68	1243.4	1.062	859.0	0.734
13	0.887	19.801	28.564	632.3	45.25	1225.6	1.047	869.0	0.743

STA 22.000 MASS AVERAGED PROPERTIES

PT= 28.777 TT= 643.26 GAMMA=1.4002 PT-RAT= 1.958 TT-RAT= 1.240

RCU= 653.5 VM= 798.5 CZ= 791.4 MM=0.672 MABS=0.676 MREL=1.183

STATOR STA= 23 000 TE STATOR

I=24 MTIP=300 AFLOW= 118.17 D*C=0. D*H=0.

WTF= 61.365 OPTX=DPP OPTY=BETM ITYPE=3 INBR=4 ABC=0. ABH=0.

PSIC	Z	R	PHI	CURV	VM	CU	ALPHAM	MM
0.	-2.567	8.500	0	0	658.2	0.	0.	0.536
0.050	-2 581	8.357	0.49	0.0062	685.3	0.	0.	0.560
0.100	-2.595	8.218	0.92	0.0090	702.9	0.	0.	0.577
0.200	-2.622	7.947	1.68	0.0123	744.8	0.	0.	0.616
0.300	-2.648	7.682	2. -	0.0182	770.3	0.	0.	0.642
0.400	-2.674	7.418	3.27	0.0266	788.1	0.	0.	0 660
0.500	-2.700	7.150	4.20	0.0376	797.4	0.	0.	0 671
0.600	-2.728	6.874	5.24	0.0503	803 0	0.	0.	0.678
0 700	-2.756	6.588	6.44	0.0653	811 6	0.	0.	0.687
0 800	-2.785	6.290	8.02	0.0936	831.2	0.	0.	0.707
0.900	-2.816	5.976	9.88	0.1247	831.2	0.	0.	0.707
0.950	-2.833	5.809	10 79	0.1318	831.2	0.	0.	0.708
1.000	-2.850	5.631	11.52	0 1267	819.5	0.	0.	0.696

SL	BLDBLK	PS	PT	TT	BETAM	VREL	MREL	VABS	MABS
1	0 940	21.479	26.109	664.4	66.31	1638.1	1.333	658.2	0.536
2	0.940	21.481	26.581	661.7	65.08	1626.3	1.330	685.3	0.560
3	0.940	21.477	26.910	658.8	64.14	1611.6	1.323	702.9	0.577
4	0.940	21.460	27.731	653.7	62.03	1587.9	1.314	744.8	0.616
5	0.940	21.430	28.269	649.0	60.40	1559.2	1.299	770.3	0.642
6	0.940	21.375	28.639	644.7	58.95	1528.0	1.280	788.1	0.660
7	0.940	21.285	28.780	640.8	57.71	1492.6	1.256	797.4	0.671
8	0.940	21.149	28.769	637.7	56.50	1454.8	1.228	803.0	0.678
9	0.940	20.961	28.750	635.1	55.08	1417.8	1.200	811.6	0.687
10	0.940	20.672	28.851	633.0	53.17	1386.8	1.179	831.2	0.707
11	0.940	20.227	28.250	631.6	51.76	1342.8	1.143	831.2	0.707
12	0.940	19.945	27.860	631.5	50.96	1319.7	1.123	831.2	0.708
13	0.940	19.643	27.159	632.3	50.49	1288.1	1.094	819.5	0.696

STA 23.000 MASS AVERAGED PROPERTIES

PT= 28.163 TT= 643.26 GAMMA=1.4001 PT-RAT= 1.916 TT-RAT= 1.24

RCU= 0. VM= 782.5 CZ= 778.3 MM=0.657 MABS=0.657 MREL=1.244

AVERAGE PCT IMM	AVERAGE RAD	BLADE SPEED IN	BLADE SPEED OUT	ACC PT RATIO	ACC TT RATIO	EFFICIENCY AD.	EFFICIENCY POLY	AXIAL VEL R
0.	8.500			1.7766	1.2809	0.635	0.663	1.192
4.8	8.340			1.8087	1.2757	0.669	0.696	1.159
9.3	8.187			1.8311	1.2701	0.699	0.723	1.132
18.1	7.891			1.8870	1.2603	0.765	0.785	1.108
26.7	7.604			1.9236	1.2512	0.818	0.834	1.094
35.2	7.316			1.9488	1.2429	0.865	0.877	1.087
43.9	7.023			1.9584	1.2354	0.900	0.909	1.084
53.0	6.717			1.9576	1.2294	0.923	0.930	1.084
62.7	6.393			1.9563	1.2244	0.942	0.948	1.092
73.1	6.043			1.9632	1.2204	0.965	0.968	1.120
84.8	5.648			1.9223	1.2177	0.944	0.949	1.143
91.6	5.419			1.8957	1.2175	0.923	0.929	1.189
100.0	5.137			1.8480	1.2190	0.876	0.887	1.175

EXIT STA= 24.000 FREE

I=25 MTIP=313 AFLOW= 116.57 D*C=0. D*H=0.

WTF= 61.365 OPTX=DPP OPTY=FREE ITYPE=0 INBR=0 ABC=0. ABH=0.

PSIC	Z	R	PHI	CURV	VM	CU	ALPHAM	MM
0.	-2.000	8.500	0.	0.	675.8	0.	0.	0.551
0.050	-2.000	8.361	0.32	0.0039	702.5	0.	0.	0.575
0.100	-2.000	8.226	0.63	0.0080	719.8	0.	0.	0.592
0.200	-2.000	7.963	1.18	0.0158	761.6	0.	0.	0.631
0.300	-2.000	7.706	1.68	0.0233	788.0	0.	0.	0.658
0.400	-2.000	7.450	2.16	0.0312	807.2	0.	0.	0.678
0.500	-2.000	7.192	2.63	0.0401	817.9	0.	0.	0.690
0.600	-2.000	6.927	3.12	0.0509	824.8	0.	0.	0.698
0.700	-2.000	6.654	3.63	0.0643	834.7	0.	0.	0.709
0.800	-2.000	6.373	4.11	0.0792	853.9	0.	0.	0.728
0.900	-2.000	6.077	4.59	0.0997	850.6	0.	0.	0.726
0.950	-2.000	5.921	4.85	0.1151	848.4	0.	0.	0.724
1.000	-2.000	5.757	5.28	0.1260	835.4	0.	0.	0.711

SL	BLDBLK	PS	PT	TT	BETAM	VREL	MREL	VABS	MABS
1	0.950	21.246	26.109	664.4	65.75	1645.2	1.341	675.8	0.551
2	0.950	21.243	26.581	661.7	64.54	1634.2	1.338	702.5	0.575
3	0.950	21.235	26.910	658.8	63.63	1620.3	1.332	719.8	0.592
4	0.950	21.202	27.731	653.7	61.54	1598.3	1.325	761.6	0.631
5	0.950	21.144	28.269	649.0	59.91	1571.7	1.312	788.0	0.658
6	0.950	21.058	28.639	644.7	58.45	1542.8	1.295	807.2	0.678
7	0.950	20.939	28.780	640.8	57.20	1509.9	1.273	817.9	0.690
8	0.950	20.778	28.769	637.7	55.99	1474.6	1.248	824.8	0.698
9	0.950	20.563	28.750	635.1	54.59	1440.7	1.223	834.7	0.709
10	0.950	20.275	28.851	633.0	52.79	1412.0	1.204	853.9	0.728
11	0.950	19.893	28.250	631.6	51.58	1368.9	1.168	850.6	0.726
12	0.950	19.654	27.860	631.5	50.92	1346.0	1.148	848.4	0.724
13	0.950	19.383	27.159	632.3	50.57	1315.3	1.119	835.4	0.711

STA 24.000 MASS AVERAGED PROPERTIES

PT= 28.163 TT= 643.26 GAMMA=1.4002 PT-RAT= 1.916 TT-RAT= 1.2[illegible]

RCU= 0. VM= 801.9 CZ= 800.8 MM=0.674 MABS=0.674 MREL=1.261

EXIT STA= 25.000 FREE

I=26 MTIP=326 AFLOW= 116.27 D*C=O. D*H=O.

WTF= 61.365 OPTX=DPP OPTY=FREE ITYPE=O INBR=O ABC=O. ABH=O.

PSIC	Z	R	PHI	CURV	VM	CU	ALPHAM	MM
0.	-1.270	8.500	0.	0.	693.1	0.	0.	0.566
0.050	-1.270	8 365	0.19	0.0025	718.9	0	0.	0.590
0 100	-1.270	8.232	0.36	0.0048	735 5	0.	0	0.606
0.200	-1.270	7.974	0.66	0.0092	775.4	0.	0.	0 644
0.300	-1.270	7.722	0.91	0.0136	799.9	0.	0.	0.668
0.400	-1.270	7.470	1.13	0.0180	816.7	0.	0.	0.686
0.500	-1.270	7.216	1.32	0.0228	824.4	0.	0.	0.696
0.600	-1.270	6.954	1.47	0.0280	827.3	0.	0.	0.700
0.700	-1.270	6 684	1.58	0.0335	831.7	0.	0.	0.706
0.800	-1.270	6.406	1.62	0.0398	843 0	0.	0.	0.718
0.900	-1.270	6.112	1.54	0.0464	828 0	0.	0.	0.705
0.950	-1.270	5.956	1.41	0.0493	817.6	0.	0	0 695
1.000	-1.270	5.790	0.00	0.1263	798.1	0.	0.	0 676

SL	BLDBLK	PS	PT	TT	BETAM	VREL	MREL	VABS	MABS
1	0.956	21.013	26.109	664.4	65.20	1652 4	1.349	693.1	0 566
2	0.956	21.011	26.581	661.7	64.03	1641.8	1.347	718.9	0.590
3	0.956	21.006	26.910	658.8	63.15	1628.3	1.341	735.5	0.606
4	0.956	20.985	27.731	653.7	61.14	1606.7	1.334	775.4	0.644
5	0.956	20.950	28.269	649.0	59.59	1580.0	1.320	799.9	0.668
6	0.956	20.898	28.639	644.7	58.22	1550.7	1.303	816.7	0.686
7	0.956	20.827	28.780	640.8	57.08	1516.9	1.280	824.4	0.696
8	0.956	20.734	28.769	637.7	56.01	1480.1	1.253	827.3	0.700
9	0.956	20.616	28.750	635.1	54.81	1443.3	1.225	831.7	0.706
10	0.956	20.466	28.851	633.0	53.29	1410.1	1.201	843.0	0.718
11	0.956	20.281	28.250	631.6	52.49	1359.7	1.157	828.0	0.705
12	0.956	20.174	27.860	63 5	52.12	1331.6	1.132	817.6	0.695
13	0.956	19.990	27.159	632.3	52.01	1296 5	1.099	798.1	0.676

STA 25.000 MASS AVERAGED PROPERTIES

PT= 28.163 TT= 643.26 GAMMA=1.4002 PT-RAT= 1.916 TT-RAT= 1.240

RCU= 0. VM= 803.2 CZ= 803.0 MM=0.675 MABS=0.675 MREL=1.264

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EXIT                         STA= 26.000                                FREE
                 I=27        MTIP=339     AFLOW=   116.28     D*C=0.      D*H=0.
WTF=  61.365     OPTX=DPP     OPTY=FREE   ITYPE=0  INBR=0  ABC=0.         ABH=0.
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PSIC	Z	R	PHI	CURV	VM	CU	ALPHAM	MM
0.	-0 350	8.500	0.	0.	710.9	0.	0.	0.581
0.050	-0.350	8.367	0.11	0.0000	735.8	0.	0.	0.605
0.100	-0.350	8.236	0.21	-0.0000	751.6	0.	0.	0.620
0.200	-0.350	7.981	0.37	-0.0000	789.2	0.	0.	0.656
0.300	-0.350	7.731	0.49	-0.0000	811.0	0.	0.	0.679
0.400	-0.350	7.482	0.57	-0.0000	824.4	0.	0.	0.693
0.500	-0.350	7.229	0.61	-0 0000	827.9	0.	0.	0.699
0.600	-0.350	6.968	0.61	-0 0000	825.4	0.	0.	0.698
0.700	-0.350	6.698	0.54	-0.0000	822.9	0.	0.	0.698
0.800	-0.350	6.418	0.39	-0.0000	825.8	0.	0.	0.702
0.900	-0.350	6.120	0.11	-0.0000	799.3	0.	0.	0.678
0.950	-0.350	5.961	-0.10	-0.0000	781.7	0.	0.	0.662
1.000	-0.350	5.791	0.	0.	748.9	0.	0.	0.631

SL	BLDBLK	PS	PT	TT	BETAM	VREL	MREL	VABS	MABS
1	0.956	20.769	26.109	664.4	64.64	1660.0	1.358	710.9	0.581
2	0.956	20.768	26.581	661.7	63.51	1649.7	1.355	735.8	0.605
3	0.956	20.768	26.910	658.8	62.66	1636.3	1.350	751.6	0.620
4	0.956	20.767	27.731	653.7	60.73	1614.5	1.342	789.2	0.656
5	0.956	20.768	28.269	649.0	59.27	1587.2	1.328	811.0	0.679
6	0.956	20.768	28.639	644.7	58.02	1556.5	1.309	824.4	0.693
7	0.956	20.768	28.780	640.8	57.02	1520.8	1.284	827.9	0.699
8	0.956	20.767	28.769	637.7	56.13	1481.0	1.253	825.4	0.698
9	0.956	20.767	28.750	635.1	55.15	1440.3	1.221	822.9	0.698
10	0.956	20.766	28.851	633.0	53.90	1401.6	1.191	825.8	0.702
11	0.956	20.765	28.250	631.6	53.50	1343.6	1.139	799.3	0.678
12	0.956	20.765	27.860	631.5	53.38	1310.6	1.109	781.7	0.662
13	0.956	20.765	27.159	632.3	53.76	1266.9	1.068	748.9	0.631

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              STA  26.000  MASS AVERAGED PROPERTIES
PT= 28.163  TT= 643.26  GAMMA=1.4002  PT-RAT= 1.916  TT-RAT=  1.240
RCU=     0.    VM= 801.3  CZ= 801.3  MM=0.673  MABS=0.673  MREL=1.263
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SECTION VI

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1. A.J. Wennerstrom, and W.A. Buzzell, Redesign of a Rotor for a 1500 ft/sec Transonic, High-Through-Flow, Single-Stage Axial-Flow Compressor with Low Hub/Tip Ratio, Air Force Aero Propulsion Laboratory, Wright-Patterson AFB, Ohio 45433, AFAPL-TR-2078, September 1979.

2. George R. Frost, Richard M. Hearsey, Arthur J. Wennerstrom, A Computer Program for the Specification of Axial Compressor Airfoils, Aerospace Research Laboratories, Wright-Patterson Air Force Base, Ohio 45433, ARL 72-0171,

3. Richard M. Hearsey, A Revised Computer Program for Axial Compressor Design Volume I, Aerospace Research Laboratories, Wright-Patterson Air Force Base, Ohio 45433, ARL TF 75-0001, January 1975.

4. Arthur J. Wennerstrom, Personal Communication to L.H. Smith of General Electric Company, September 12, 1980.